



## IF THE TELEPHONE WERE NOT THERE!

MANY times each day you reach for the telephone on your desk at the office or beside your easy chair at home. It is an old and trusted friend. You scarcely give a thought to what it means to a busy day.

Yet suppose the telephone were not there! Suppose—for a week—

or a month—you could not call anybody by telephone and nobody could call you!

The whole machinery of business and the home would be thrown out of gear. Orders would be lost—efficiency and profits reduced. You would be out of touch with the world about you.

America needs quick, reliable telephone service to get things done in the brisk, crisp American manner. And it enjoys the best service in the world.

Greater progress has been made in this country because of the Bell System's one policy, one system and universal service.



America leads in telephone service. In relation to population there are six times as many telephones in this country as in Europe and the telephone is used nine times as much.

**BELL TELEPHONE SYSTEM**

tract the fuel for the return trip from the other planet. The scientists say that the planets all came from the sun, so they should have the same elements.—J.P., St. Louis, Mo.

### Hope We're Not Giving Away Any Family Secrets

THE figures below, which appear to contain a message in code or cipher, were found by a friend and me while examining some valuable papers. We attempted to decipher it on the basis of repetition, frequency, and plain guesswork, but have been unable to get anywhere with it. The figures are on what appears to be an ordinary piece of letter paper, without a watermark, and are written in ink without spacing between lines. There is nothing else on it.

942293906259174689409008703016

34588190586389942425317537919

637962464489466218872263807539

Maybe one of your bright readers can figure it out for me.—W.J.G., Jersey City, N. J.

### Value of Rat Power Is Definitely Established

L. H. T. of New York, in his answer to the question about the power that might be received from expanding metal, was a little strong in ranking the metal with a fly, when probably it should have been ranked with a rat. The expansion of an iron rod one foot long if raised in temperature fifty degrees Centigrade is about .0005 feet. Now, the Young's modulus of iron is about 5,000,000,000 pounds per square foot transverse section; therefore, the force which the rod is capable of exerting, is 5,000,000,000 X .0005 pounds, which is equal to 2,500,000 pounds, instead of the 100 pounds that L. H. T. assumed. This force, however, would prevent the rod from expanding at all, but if the applied load is half of that, the expansion will be about half of its amount with no load. If the rod is 100 feet long, the half expansion total will be .025 feet, and the work done will be 30,000 foot pounds. If that is done in twenty-four hours the power will be .0006 horsepower, or .5 watts, which is considerably more than the .00011 watts which was given. And, now, for the rat-power rating which I arrived at. One horse power is equivalent to 746 watts, but a real, average horse can only do about three fourths of this, or about 571 watts, and for a horse weighing about 1,150 pounds, that is about .5 watts per pound. Hence, with the same ability rate, a rat weighing one pound would make a good substitute for the iron rod. If the rod were two square feet in section, you would have to have two rats.—J.B.D., Raleigh, N. C.

### Astronomy Fan Makes a Modest Request

AFTER seeing what the chemistry enthusiasts have done to your magazine, one would almost think that he could get anything if he howled long and loud enough. Nevertheless, what I'm aiming at is this: a little dope on the casting and grinding of telescope mirrors and lenses would be well in line with the current interest in such things. It would help a lot of us who can't exactly afford astronomy books but can't get along without POPULAR SCIENCE MONTHLY.—I.N., Coeur d'Alene, Ida.

WINNIE NUMBANS,  
BOY!



### Taking Secret Pictures Is No Snap, Says He

IN GIVING suggestions for taking secret pictures (P.S.M., Oct. '34, p. 27), you neglected to caution your readers that the results of this kind of work will not be what one generally considers satisfactory. Since the negatives usually require great enlargement, especially with the midget cameras commonly employed, it is necessary to have both a view finder for locating your object, and a range finder for setting the correct distance. Casual snapping is at best just a stunt.—H.F.G., Milwaukee, Wis.

### Exploding Lead Puzzles This Home Chemist

WORKING in my laboratory the other day, I found it necessary to melt some lead for an experiment. I placed the lead in a crucible and heated it, but before it had all melted, the whole crucible of lead exploded and flew all over the room in small particles, solidifying as it shot through the air. I tried it again with the same result. Was this some special kind of lead? Perhaps expanding air bubbles in the lead caused it. If not, will some one put me straight? But don't tell me the atoms exploded!—A.H.A., Egg Harbor, N. J.

### Have a Try at These Tricky Triangles

I WONDER if, among your readers, there are not some who would be interested in solving a couple of brain teasers suggested to me several years ago. First: given a triangle, to divide it (by a line through the vertex) into two triangles the incircles of which shall be equal (See Fig. 1). Second: to divide a given triangle by lines through a given vertex into three triangles whose incircles shall be of equal radii. If in each case the sides of the triangle are 7, 11, and 15, what are the lengths of the radii? Perhaps these problems are easily solved, but I'd like to see who can give the easiest construction which obtains the circles and makes possible the suggested computations.—O.J.B., Seattle, Wash.



### Cats Will Appreciate This Handy Drinking Place

HAVING noticed the amount of space in a recent issue devoted to the lowly cat, I offer the following suggestion: A handy drinking saucer for cats can be made from a china tumbler-holder such as is seen in every bathroom and can be bought in any dime store. Screw the bracket to the wall about three inches above the floor. The holder can be removed for cleaning, and it has the advantage that it cannot be tipped over. And another thing: I noticed some time ago an item stating that half of a hollow rubber ball makes an excellent grease preventer around the transmission above the floor of an old car. I'll go you one better: Use a large-mouth rubber nipple. This is much easier and fits much tighter.—T.M., Charleston, S. C.

### He Has a Model of an Unsinkable Submarine

I MADE with P. S., New York City, about the models. Mr. Gommi is doing a fine job. I have made many models from your plans, including the *Servitor*, *Sea Witch*, and rocket plane. I wish you would have Mr. Gommi or Mr. Clark make some plans for a model submarine, either working or scale, but preferably scale. I have a supposed working

model that won't even sink. You could be made to scale with the others in the series, or larger.—T.C., Knoxville, N. Y.

### The Bullet-Problem Bug Claims Another Victim

JUST another victim of the bullet-problem epidemic. Suppose that Old Man Earth were to shoot an apple off the head of the Man in the Moon with a rifle. Would 100 per cent of the force ordinarily exerted in producing the kick be converted into heat against the breech? Another: A Winchester .22 long-rifle cartridge with a forty-grain bullet has a muzzle energy of 174 foot pounds. Now, suppose that a second forty-grain bullet is fitted into the primer end of the cartridge, the powder charge remaining the same, and this double-bullet cartridge is fired in the center of a barrel open at both ends. Would either bullet have a muzzle energy of 174 foot pounds?—H.B.G., Portland, Ind.



### Looks in Vain for "Well-Known" Phenomenon

THIS article on "Rainbows and the Sun's Green Flash" (P. S. M., Oct. '34, p. 32) is the kind of thing we have been waiting for. It has always been a pleasure to me to trace such phenomena as the green flash and learn their causes. In this pursuit I come across accounts of manifestations of physical optics which are described as being everyday occurrences but which I have not been able to recognize. The most interesting of these is Huygen's Brushes, described by Helmholtz in the paper published in the Harvard Classics. He claims that it is a well-known phenomenon, but I have not found anyone who has ever heard of it. Although Helmholtz says that any one who looks for it can see it, I have not found this to be the case, and concluded that I am not sufficiently well informed to know exactly what to look for. I am wondering whether some of your readers can help me to find this interesting display of polarized light. Another phenomenon that has aroused my curiosity is the green line that is said to be visible in the light reflected from the sky.—L.A.M., Sault Ste. Marie, Mich.

### Groaning Board Becomes a Talkative Table

IS there really such a thing as spiritualism? Recently, a friend showed a group of us a great little party trick and had a wooden table knock out answers to the questions we put to it. The table told the correct ages and other facts about all the people in the room. Naturally, we all suspected a trick. However, a few nights later, with the scene changed entirely, I tried the trick with several people who had not been present at the previous seance. To my own astonishment, as well as that of my friends, the table rose and tapped out answers as the other had done. This time it was absolutely impossible for a trick to be involved. Now, is there a scientific solution to this problem? What is there in a human body to make a table rise and fall, and tap out answers, mostly correct, to the many questions asked of it? Do you know?—E.J.W., Brooklyn, N. Y.



RAYMOND J. BROWN, *Editor*

# Streamlined Trains

## HERALD NEW SPEED ERA

*By Alden P. Armagnac*

**W**HEN a streamlined train whizzed across the United States in less than fifty-seven hours, a few weeks ago, its feat marked the beginning of a new era in railroading. Not only had it shattered every world's speed record for a fully-equipped train, but still more impressive, to the railroad executives aboard, was the fact that the spectacular test run had proved such speeds practical for everyday passenger service. Hardly had the Union Pacific's projectilelike, six-car aluminum train, the *M-10,001*, glided to a stop at the New York terminus of its transcontinental dash from Los Angeles, when officials of the line announced that they expect to have a fleet of three such trains in actual operation by the end of the winter. Regular scheduled runs between Chicago and the west coast will be made weekly by the *M-10,001* and by two nine-car trains of similar design, now under construction. The fastest trains now require fifty-five hours for the trip, but the new ones will make it in forty hours or less. Thus they will slash a whole business day from the time of a coast-to-coast journey by rail.

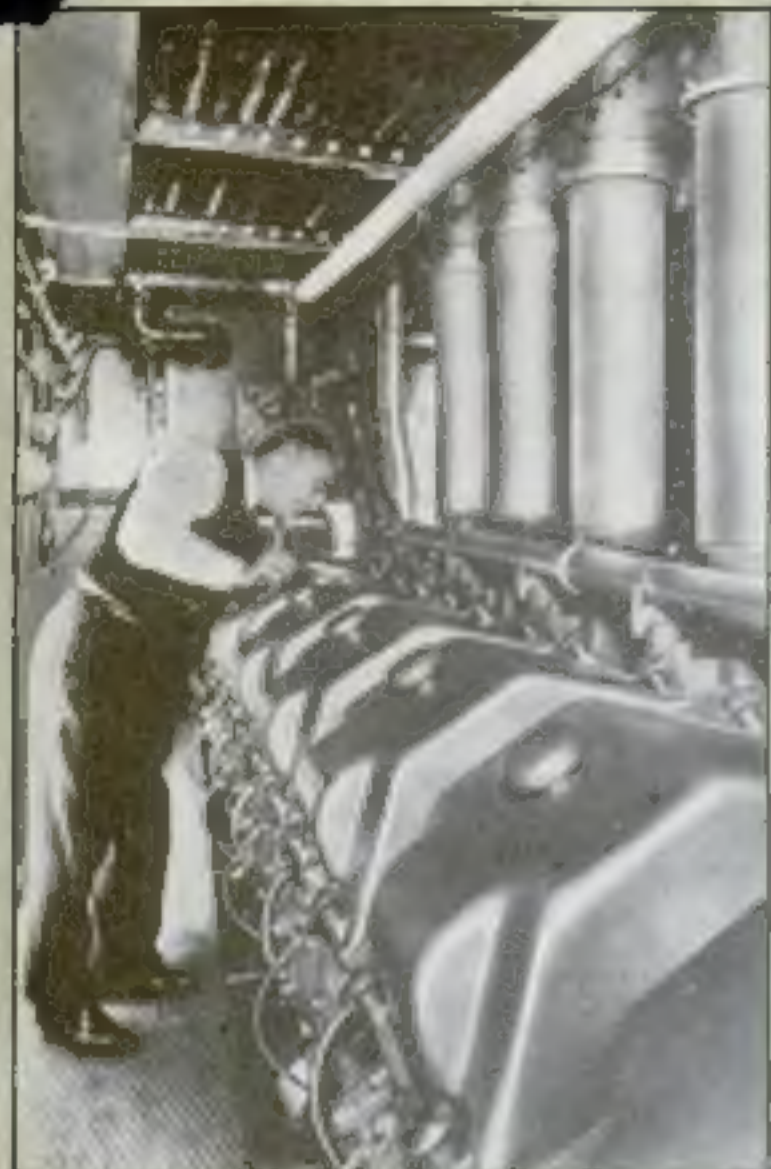
Today, bullet trains, like the Union Pacific's *M-10,001* and the Burlington's *Zephyr*, another recent record-breaker, are regarded as curiosities by throngs that flock to see them wherever they are exhibited. Tomorrow, they will be a standard means of travel. Already, they have passed triumphantly through their experimental stages, and it now seems to be a race to see who can build them fastest.

Two bullet trains are nearing completion, at this writing, for the Baltimore and Ohio Railroad—one to be pulled by Diesel power, the other by a revamped and streamlined steam locomotive. Two trains duplicating its famous *Zephyr* are under construction for the Burlington System. The Boston and Maine has ordered a streamlined train, as has also the New Haven. Both the Illinois Central and the Gulf, Mobile,



**NEW TRANSCONTINENTAL RECORD BREAKER ON RAILS**

This photograph of the Union Pacific's streamlined train, *M-10,001*, was snapped during its recent record-breaking dash from Los Angeles to New York



Above, the 900-horsepower Diesel engine that drives the new train



Left, rear view of the Burlington's streamlined Zephyr showing how the tail is rounded off to minimize the drag of train's air currents

vation in streamlined-train equipment.

Outside, the train is painted canary yellow and brown. The color scheme was not a chance selection, but was chosen as a safety precaution. Tests demonstrated this combination to have the greatest long-distance visibility. An ear-piercing siren for cross-country use, and one lower-pitched for metropolitan zones, announce the approach of the flyer. At night the regular headlight is supplemented by another that casts a vertical beam as a warning to motorists nearing a crossing.

One of the most

striking impressions of an observer seeing the train for the first time is its lowness. Skillful design has dropped the center of gravity twenty inches nearer the rails than in standard coaches. It is this, that enables the train to round curves at high speed without danger of jumping the tracks. To a passenger, there is a surprising freedom from swaying and lurching, even on sharp curves.

Accommodations for 124 passengers are in keeping with the train's mechanical innovations. Pullman-car appointments include such novelties as individual washstands and mirrors that unfold from the walls of the compartments; sliding aluminum curtains, working like the roll tops of desks, replace the usual ones of cloth and completely enclose a berth; folding ladders, lowering at a touch, for the convenience of a passenger entering an upper berth. A curtain drawn about the top of the ladder permits the upper-berth occupant to rest his feet upon it and dress or undress in security and comfort.

To an engineer, however, the most fascinating car of the train is the power car. Here is the Diesel-electric plant that drives the train—a miniature, self-contained power station that generates electricity and then uses it to run motors at-

and Southern plan bullet train service. Still others are likely to follow in the near future. No longer are streamlined trains an experiment.

Old-time railroad men may well look askance at these worm-shaped, bullet-nosed apparitions of the rails. The driver of a train has ceased to be an engineer—he is a motorman. His locomotive has become a power car. A streamlined train is said to have a maximum speed and a cruising speed, as if it were an airplane. Outlandish words to a veteran railroader, they show how the sciences of motor engineering and aerodynamics have combined to provide the railroads with a vehicle so strange that it demands a whole new vocabulary.

The M-10,001, most completely equipped streamlined train yet put on rails, typifies this new departure in transportation. Like its experimental predecessor, the three-car M-10,000, it resembles an elongated airplane fuselage. Since the end of each car overlaps the next, to give a smooth air flow and decrease wind resistance, it is hard to tell at a glance where one car begins and another ends. There are six in all: the power car, a mail and baggage car, a buffet coach, and three Pullman sleepers, the last being a decided inno-



#### ALUMINUM CURTAINS ENCLOSE BERTHS IN NEW TRAIN

Sleeping cars on the M-10,001 have sliding aluminum panels that convert each berth into a compartment. A platform makes dressing and undressing easy. At the right, the same compartment as at left with the aluminum curtains rolled back

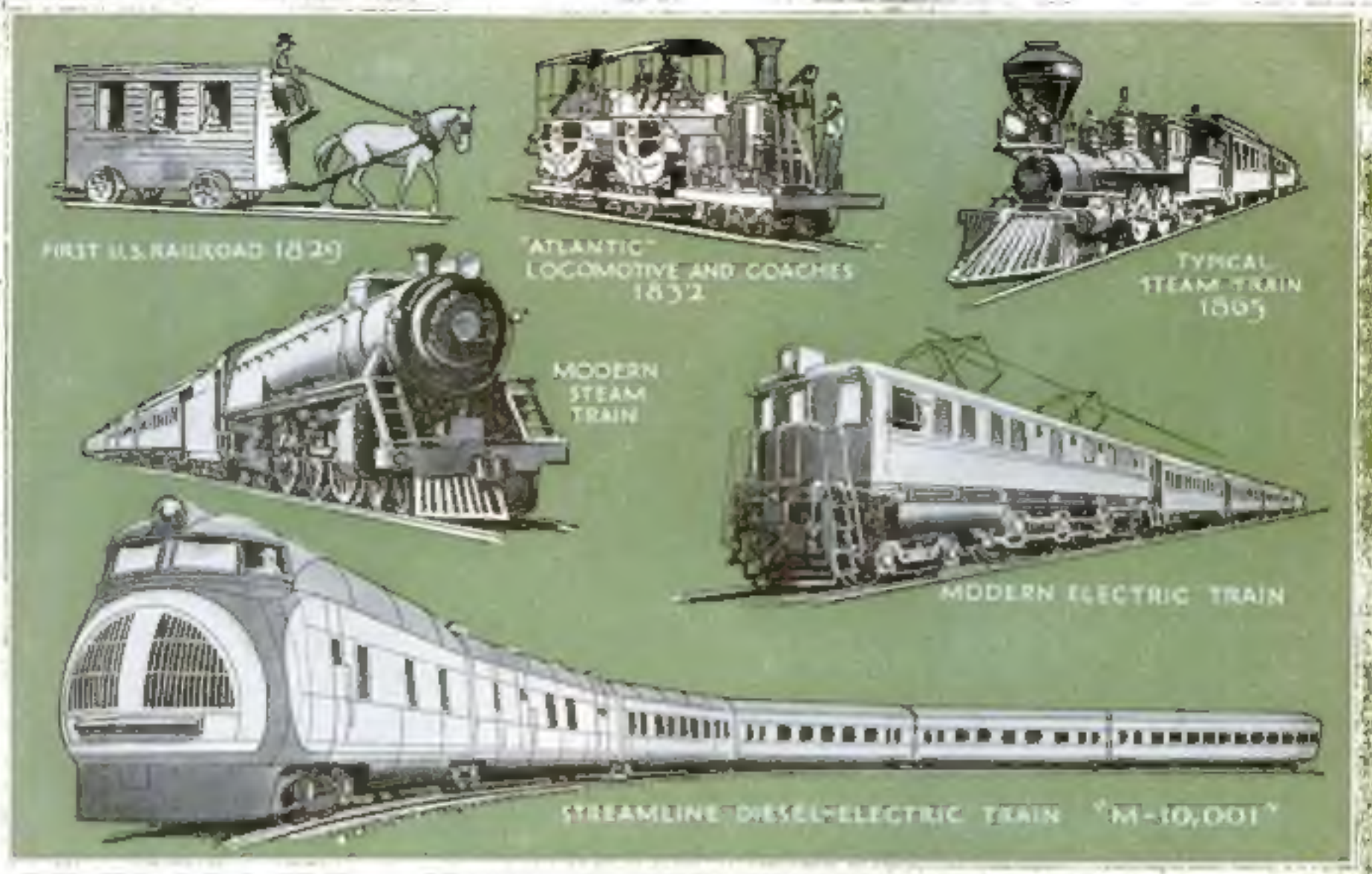
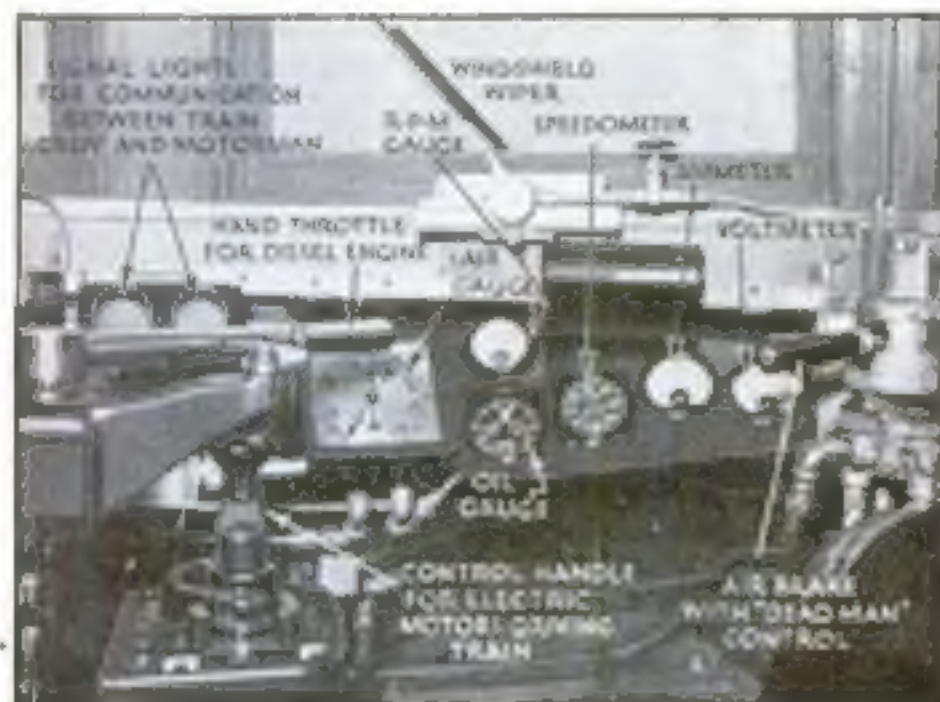


Illustration above shows the evolution of the railroad, from the horse-drawn street car, to the two-mile-a-minute train of the present



Controls like these of an automobile are found in the bullet train

tached to the driving wheels of the train.

A 900-horsepower, twelve-cylinder Diesel engine, burning low-cost fuel oil, is the source of the power. Patterned after the engine of a submarine, it is said to be the first of its type ever installed in a passenger train. To an engineer, its V-shape, its two-cycle design, and the enormous pressures carried in its cylinders stamp it as a radical departure from standard practice. Even a layman can appreciate the amazing compactness of the engine, which, despite its power, occupies a space only twenty feet long, eight feet high, and less than six feet wide. Rakish funnels, protruding through the roof of the power car, serve as exhausts, replacing the smokestack of a conventional locomotive.

structed view of the track ahead. Within easy reach of his left hand is a throttle that regulates the Diesel engine, and an electric control handle, not unlike that of a trolley car, that governs the speed of the train. At his right is the air-brake valve with its "dead man" control—a safety device upon which the motorman must keep either his hand or foot while the train is moving. Should he relax his hold on one or the other, for any reason, the throttle closes and brakes go on automatically, stopping the train. Dials on an instrument board enable him to keep tab on the engine and motors, and red and green signal lamps permit intercommunication with the train crew. A speedometer, an unusual train accessory, shows the speed in miles per hour. Not only do the

Coupled to the Diesel engine is a generator, and the electricity it produces runs the four traction motors on the trucks of the power car that propel the train.

Over this maze of machinery presides the motorman, clad in spotless white overalls, and presenting a striking contrast to the usual picture of an engineer. Sitting at the right-hand side of a cab that is elevated above the rounded nose of the train, he has an unob-

controls resemble those of an automobile, but they are handled as simply. A duplicate set is provided at the left-hand side of the cab for a second operator.

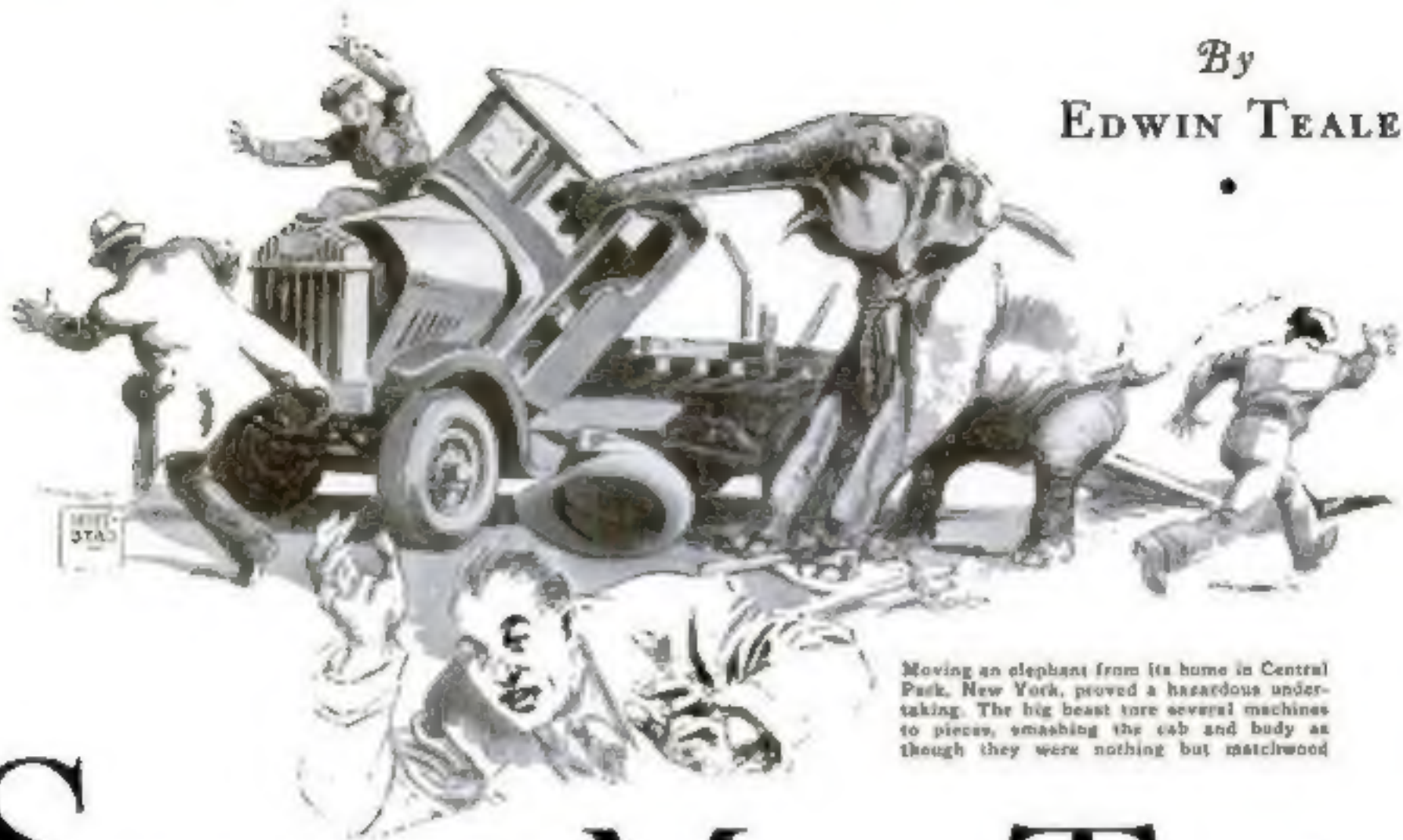
This, then, was the new-type train that swept out of Los Angeles one Monday night at ten P.M., Pacific Time, and started east in a race against the clock. Passing over the plains after leaving Cheyenne, Wyo., the man at the controls opened them wide to see what the train could do. The speedometer needle crept to 120 and hung there, while the M-10,001 clipped off two miles in one minute flat, a record that has been equaled by no other fully equipped train in the world.

Into Chicago whizzed the streamlined train, just thirty-nine hours out of Los Angeles, and all previous records for this 2,364-mile run went by the board.

From Chicago to New York, in the words of the motormen who ran it in two-hour shifts, the M-10,001 "just loafed along." Nevertheless it beat the time of the crack Twentieth Century Limited by twenty minutes. The streamlined train arrived in New York City at 9:55 Eastern Time. Thursday morning, having completed the transcontinental dash and made several stops en route in the amazing time of fifty-six hours and fifty-five minutes. Averaging nearly sixty miles an hour, the train had lowered the railroad coast-to-coast time by fourteen and a half hours.

Such trains as this are the railroad's answer to the airplane. They represent so radical a change in style of transport that one comparable hardly can be found in railroad history. As the railroads evolved, there have been certain major steps of progress, the change from wood-burning locomotives to coal burners, for example, and the rise (Continued on page 97)

By  
EDWIN TEALE



Moving an elephant from its home in Central Park, New York, proved a hazardous undertaking. The big beast tore several machines to pieces, smashing the cab and body as though they were nothing but matchwood.

# Stunts by Motor Trucks

**F**ORTY-FOOT whales, hundred-ton statues, speed boats, trolley cars, elephants, around-the-world airplanes, roadside diners—all these have ridden on the motor trucks of the Gerosa Haulage and Warehouse Company. This New York organization, a concern unique in America, specializes in handling the biggest, the heaviest, and the most unwieldy objects hauled by truck.

Right now, for instance, its trucks are rolling through city traffic bearing im-

mense 120-ton trusses of steel. They will form the skeleton of a new skyscraper at Radio City. By applying science to the designing of special equipment, the organization is breaking records and making trucking history.

Ninety feet below Prospect Park, in Brooklyn, N. Y., a few years ago, engineers came to the end of tunneling operations for a new subway. Usually, the crown shields, or great metal rings that protect workers digging at the nose of a tunnel, are turned to one side and buried in concrete at the end of a job. In this case, the company had another tunneling job which it was to begin immediately a mile and a half from the spot. To make new shields would require three months and cost \$40,000. Could the Gerosa company bring the two 326,000-pound rings to the surface and transport them a mile and a half? It could and did.

Burrowing straight down, workmen gradually jacked up the shields to the surface, raised them on cribbing, built a heavy platform beneath them, and then lowered them onto special gooseneck trailers. One at a time, the rings, towering twenty-five feet in the air, were towed through the streets, their immense weight distributed over eight wheels with huge cushion tires. The trips were made after ten o'clock at night with linemen from the street-car company going ahead to cut the trolley cables and let through the huge rings riding on gigantic trailers.

Those trips still stand as an all-time record for the heaviest objects ever hauled on trailers through a city street. On such assignments, the experts of the Gerosa company go over the pavements looking for weak places and study maps showing the exact location of water mains and manholes before they pick a route for the trucks.

Weight, however, was a minor consideration in one of the most exciting jobs ever undertaken by the company. Last winter, CWA workers began improvements on the buildings in Central Park, New York. Chang, a young female elephant, had to be moved to new quarters in Brooklyn while the work was going on. As



Above, truck moving the great metal ring that is used to protect tunnel workers—heaviest object ever carried on a trailer.



Chang weighed less than three tons, the task seemed easy.

Another trucking company first took the assignment. Its driver brought a new machine out and backed it up to the elephant house. Half an hour later, the machine limped away almost dismantled. Chang had torn the side structure to pieces, had demolished the cab, and had left little more than the chassis. A second concern took the contract. Again the elephant smashed the woodwork on the truck and battled forty men in resisting efforts to get her aboard.

ONE after the other, seven trucks drove in to Central Park and drove out again defeated. In one case, Chang picked up the cab of a truck and hurled it aside as though it had been a match box. In another instance, she tore the panels from a van. Finally, the trouble shooters of the Gerosa company were handed the job of getting the elephant to Brooklyn.

When their truck swung into position, an army of men was on hand to help. But none of them was needed. The truck had been fitted up to resemble a tent. Above the twelve-and-a-half-foot side racks was an arched canvas cover and on the floor of the truck was a thick layer of straw. Around the rear of the elephant, the men placed a heavy harness hitched to a power winch. Every time the animal began to slow down on the heavy planking leading into the truck, the winch started and gave her a boost.

Once inside, she was chained to the floor and her trunk fastened securely to a heavy belt encircling her middle. In this way, she started on the twelve-mile ride through traffic and across the East River to the Brooklyn Zoo. The excitement began soon after Central Park was left behind. A near blizzard arose and snow piled up on the canvas cover.

Then Chang broke her trunk free, ripped the canvas and began attacking the uprights.

A keeper riding with her would tap her trunk with a stick every time she grabbed an upright, thus preventing serious damage. But the driver was on the verge of the fitters when the trip was over. During the last few miles, Chang had been writhing her trunk around the side of the cab, snorting in his ear, and making passes at the steering wheel. All the way across the Manhattan Bridge, spanning the East River, she had swung her trunk from side to side trying to grab the ironwork of the bridge as she went by.

Compared to that ride, hauling a forty-foot captive whale was a cinch. The whale reached New York in a special seventy-two-foot exhibition car at the end of a transcontinental tour. It had died and drums of formaldehyde had been injected to preserve it. By the time it reached New York, it weighed, with its car, more than ninety tons. Then it was discovered that the car was so long it couldn't round the sharp curves on the railroad leading to

(Continued on page 107)



Above, 100-foot section of steel brought by truck to scene of railroad construction and hoisted in to place by company's big crane

Right, 110-foot steel boom used to lift statue to top of fifty-foot column. It was moved by trucks along city street



Above, street car loaded on truck and trailer is moved six miles across country to new tracks. Left, how trucks and trailers were used to move whale in seventy-two-foot car



## CLASSROOM EXPLORERS STUDY JUNGLES



on a set so powerful that it can communicate with exploring parties in all parts of the world. Besides these important studies, the young explorers are taught geology, weather forecasting, and other sciences that will enable them to carry out scientific researches. Two ship models are on hand to be used in solving problems of navigation. Buoya, channel markers, and lights on ships give the studies realistic touches.

These ship models and compasses are used by exploration students in classroom.

**W**ITH a veteran explorer as guide, Harvard students, in the only school of its type in the world, can make exploring trips to the Arctic and to equatorial jungles without leaving the classroom. The school, known as the Institute of Geographical Exploration, is supplied with all the equipment necessary for safe travel and for bringing back scientific data. Prospective explorers may practice aerial photography and mapping with the latest available cameras, learn how to navigate by land, sea and air and how to check a compass. They receive radio instruction



Composite air photograph of Cape Cod made to teach students how to prepare air photos



### LEVEL FOR ALL WORK

HORIZONTAL surfaces, and those at all angles of pitch, can be checked by a new level. The bubble tube is mounted in a barrel that can be rotated at will. To check a forty-five degree beam for example, the barrel is turned to this reading and the level placed against the beam. If the latter is true, the bubble in this unusual level will come to rest at the center.



Above cutaway view of wrench in use. At left, making solderless connection

### SOLDERLESS CONNECTOR

A new solderless connector for electrical work eliminates the use of blowtorch and soldering iron, and assures a perfect connection. The powerful leverage of the socket-head wrench, turning a hollow set-screw, provides a positive mechanical and electrical connection. The connector is manufactured in eight models that fit all wire sizes.



### MAGNIFIER IN PENCIL

A MECHANICAL pencil, combined with a magnifier, has just made its appearance. The pencil is a regular propel-repel model that takes the standard size leads. It has a crystal-clear half that magnifies fine print.

### U. S. DYES MOSQUITOES

PINK mosquitoes form the latest addition to the U. S. Government's equipment for fighting insect pests. The Department of Agriculture sprays the mosquitoes with dyes, in a study of their movements.

### REALITY SEEMS PICTURE BUT PICTURE LOOKS REAL

A view that looks like a picture, and a picture that looks like a view, are shown in the two accompanying photographs. Admiring the landscape from the window of his hotel at Bend, Ore., the proprietor decided to put a picture frame around the window. Within this artificial setting, the visitor sees the Deschutes River and, beyond, the peaks known as the Three Sisters. Conversely, the Auto Club of France mounted a transparent photograph of mountain scenery, ten feet high and eight feet wide, and set in a frame resembling a window. Illuminated from behind, the transparency gives the effect of an Alpine view in the midst of Paris.



Above, a picture that looks real and left, a real view that makes you think it is a picture

## WASPS TO FIGHT SPIDER MENACE



Inventor of light-ray gun exhibits model of his strange weapon that blinds victim

### GUN SHOTS LIGHT RAY INSTEAD OF BULLETS

**S**HOOTING light rays instead of bullets, a mercy gun, devised by a French inventor, was recently demonstrated before military officials of that country. The strange device is intended to throw so dazzling a glare that it temporarily will blind an opponent, thus rendering him helpless until he recovers his vision. A hand-sized model of the light-ray gun, exhibited by the inventor, fires cartridges that are said to emit a light of several million candlepower when the trigger is pulled, igniting a secret mixture resembling photographic flashlight powder but burning with many times its brilliance. A reflector concentrates the beam, which lasts for twelve seconds. Animals upon which the rays were directed, in tests, were reported to have fallen to the ground, blinded and paralyzed, and to have regained consciousness only after several minutes. The inventor proposes that gigantic forms of the light-ray gun, using reflectors of 150-foot diameter, could be used to combat air raiders. Pilots of the hostile machines could be blinded by the glare, he maintains, and would lose control of their craft and crash to earth. Use of the mercy gun against infantry is also said to be a possibility.

Below, Black Widow spider and egg sacs that hatch hundreds of young



Right, the poisonous spider held in the hand, showing it is not dangerous unless it is provoked

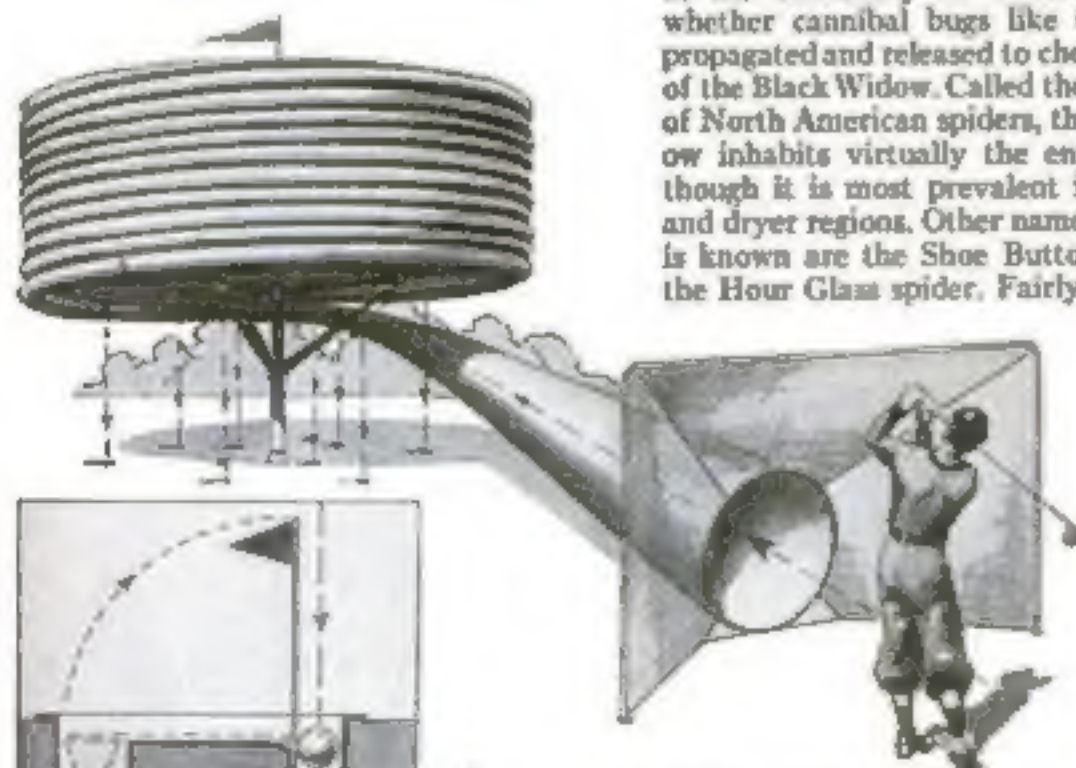


From these spider cocoons, wasps hatch out, suggesting they can be used to control spread of spider

and jet-black in color, its body resembles an oversized shoe button and bears on its under side the Black Widow's distinguishing mark, a bright red hour glass. Favorite haunts of the Black Widow are old buildings, where it usually weaves

its web in corners near the floor, and the spaces beneath houses and sidewalks. The web is a criss-cross mass of silk threads. Drop for drop, the poison of the Black Widow is more deadly than rattlesnake venom. Popular report blames the spider's bite for numerous deaths. However, contrary to a popular misconception, the Black Widow will not deliberately bite a human being; it does so only in self-defense or when its web is disturbed. If a person in a dimly-lit room, for example, accidentally pokes a finger into its web, the spider dashes from its hiding place and bites, as it does when an insect or any other object disturbs the strands. It will also bite when squeezed, as in donning clothes in which it may be lurking. However, a Black Widow may be held in the hand with comparative safety. The sudden increase in numbers may be due to unusually dry years or its natural enemies may have been destroyed. If so, experiments now under way may replace these enemies. On the other hand, scientists say, the apparent increase of the spider may be due to a more general recognition of the spider by the public.

**M**ILLIONS of tiny wasps may be mobilized to fight the new menace of the Black Widow spider. With the country alarmed by the remarkable spread of this poisonous creature in recent months, scientists have been seeking a means of control. A western research worker, hunting the cocoons of the spider, found a few riddled with holes as if another insect had bored into them. When the cocoons hatched in laboratory incubators, not spiders but tiny wasps emerged. Parasitic wasps had laid their own eggs within, and the wasp larvae had eaten the spider eggs. Another parasite was later discovered, a fly resembling a large gnat, whose young also eat the spider's eggs. Experiments are now being conducted at the University of California to learn whether cannibal bugs like these can be propagated and released to check the spread of the Black Widow. Called the most deadly of North American spiders, the Black Widow inhabits virtually the entire country, though it is most prevalent in the milder and dryer regions. Other names by which it is known are the Shoe Button spider and the Hour Glass spider. Fairly large in size



Golf-driving device that tests player's skill at the long shots

### TESTS SKILL OF GOLFER

**L**UCK plays no part in the operation of a new device known as a rotary golf machine, invented to test driving skill. Standing inside a small room, the golf devotee will be able to drive without breaking mirrors or windows, and obtain a sure test of his driving ability. To try his skill, the golfer steps up in front of a chute and tees off. The ball travels into a cone-shaped device circling upward in a rotary path, and contacting sensitive mercury switches every fifteen yards. These switches make tiny red lights flash on so the golfer can tell how far the ball is going. When it stops, it drops into a spout and lights give the yardage.



Towed by two tractors, this huge grain elevator was moved eleven miles across the country

## GRAIN ELEVATOR TAKES AN ELEVEN-MILE TRIP

A TOWERING grain elevator went on an eleven-mile journey, the other day, in one of the most unusual of moving jobs. To avoid blocking roads, it was taken directly across country over rolling and hilly farm land, streams and railroads. The eighty-foot-high building traveled upon an endless-tread carriage, with two ten-ton tractors providing motive power. Temporary bridges were built to help the building over streams and railroads. The journey was completed successfully in four days without damaging the structure's walls.



New High-intensity mercury-vapor street lamp that gives almost pure white light

## PENCIL WILL NOT TIRE WRITER



DESIGNED to prevent writing fatigue, a pencil recently placed on the market has its lower end shaped to fit the fingers. This design makes it almost impossible to write at a cramped angle that might tire the hand, and prevents the fingers from slipping down toward the point. The pencil contains a reserve supply of the leads.

## MERCURY LAMPS GIVE NEAR-WHITE LIGHT

THE first high-intensity mercury-vapor lamps ever employed in street lighting in this country were installed recently in Lynn, Mass. Instead of the greenish-violet light given off by low-pressure mercury tubes, the new lamps emit rays that are nearly white. This is accomplished by combining an ordinary incandescent bulb with a high-intensity mercury tube as shown at left. As the tube heats up, pressure is built up inside it and it gives off whitish rays which combine with the red and yellow rays from the incandescent bulb.

## NOISIEST ROOM TESTS SOUNDPROOF WALLS



Left, acoustic laboratory where sound-absorbing wall materials are tested. The "noise room" is seen in the foreground. At right, the loud-speaker swings on pendulum



To A testing chamber of an Eastern acoustical laboratory might well go the dubious honor of being the noisiest room in the world. A bedlam of ear-splitting noises produced here tests the performance of sound-absorbing wall materials. Microphones in the chamber, and recording instruments in an adjoining room, enable engineers to make tests without being exposed to the din, which is produced by a loud-

speaker hung on a pendulum. The swinging speaker distributes the sound evenly, and walls set slightly askew to one another minimize interference that would otherwise be set up. In contrast with the racket of this reverberation chamber, a "quiet room" constructed nearby is practically without sound.



Section of photograph made with new screen showing unusual etching effect

## PHOTOS LOOK LIKE ETCHING

PHOTOGRAPHS that look like etchings are obtained in a process just perfected by a California expert. This striking effect is attained by the use of a special transparent screen bearing an imprinted pattern of fine lines, which is inserted in the negative



Placing screen in contact with sensitized paper

holder of the camera with the plate or film, and through which the picture is taken. Development makes permanent the etched effect on the negative. An alternative method permits contact prints or enlargements showing the etched effect to be made from ordinary negatives, in this case the special screen is simply placed against the sensitized printing paper and the print or enlargement is made in the usual way without losing etched effect

## PILL DISPENSER FITS POCKET

OPERATED by turning its rounded bottom with the thumb, a new pill dispenser delivers one tablet at a time. A spring forces the tablets downward into contact with a metal cup. As the cup is rotated, it picks up the tablet.



## NEW KEYBOARD AIDS GUITAR PLAYER

To simplify the task of fingering a guitar, an Oklahoma man has invented a keyboard designed to fit over the neck of the instrument. The attachment contains 108 keys, corresponding to the eighteen tones that can be sounded on each string. In playing the guitar, a performer merely presses one of the smooth topped keys instead of pressing directly upon the strings. Keys comprising a chord are painted so they can be distinguished.



With this keyboard, a guitar is played without the fingers touching keys



## MECHANICAL MAN HEARS AND SPEAKS

A MECHANICAL man that understands and obeys spoken commands has just been brought to this country and placed on exhibition by its British creator, Professor Harry May of London. When such orders are given as "Wake up," "Stand up," and "Raise your right arm" the robot promptly obeys, also firing a blank-cartridge pistol when directed. When asked, "How old are you?" it replies, "Fourteen years," in a sepulchral voice. Directions are given in carefully couched phrases, the automaton remaining motionless if the wording is changed. Its brain is an electrical oscillograph that records and recognizes certain patterns of voice modulations, operating the motor-driven figure and its loudspeaker voice through selective relays. Before this mechanism was perfected, the figure occasionally played strange pranks, according to May. Once it mauled an assistant and on another occasion it shot unexpectedly at its creator, as if endowed with the malevolence of a mechanical monster of fiction. At present, however, the robot is on its good behavior and runs docilely through its repertoire of twenty or more answers to questions, also executing a wide variety of motions on request.



## FROSTED GLASS GUARDS RAILROAD SEMAPHORE

LEST an engineer fail to see a signal camouflaged by foliage, or interpret its meaning correctly, a British railroad is fitting its semaphores with safety-first screens of frosted glass. Against one of these white backgrounds, the position of the signal arm can be seen at a considerable distance.



Let me know  
if you can find  
the book "The  
History of the  
Airship" by  
H. G. Wells  
and "The  
History of the  
Airship" by  
H. G. Wells  
and "The  
History of the  
Airship" by  
H. G. Wells

The book  
"The History of  
the Airship" by  
H. G. Wells  
is a very  
interesting  
book. It  
contains  
many  
facts and  
figures  
about the  
history of  
the airship.

## Regular Airship Flights Berlin to New York Will Start Next Summer



**H**AVING BEEN  
discussed for  
years, the  
idea of a  
regular airship  
service between  
Berlin and New  
York is now  
being seriously  
considered by  
the German  
government.  
A plan has been  
drawn up by  
the National  
Advisory  
Committee for  
Aeronautics  
which provides  
for the use of  
the Graf Zeppelin  
for this purpose.  
The plan is to  
start the service  
next summer.  
The first flight  
will be made  
by the Graf  
Zeppelin, which  
is the largest  
airship in the  
world. It is  
capable of  
flying for  
days at a  
time and can  
carry a large  
number of  
passengers.  
The service  
will be very  
convenient  
for travelers  
between  
Europe and  
America.

giant airships for commercial transatlantic service is being urged upon the government by the National Advisory Committee for Aeronautics.



Uniformed men from the Friedrichshafen naval school keep sightseers out of the way as the Graf Zeppelin ground crew prepares to walk the airship out of its hangar at start of flight.

Below the airship is the airship which  
 this is the carrier of the airship  
 of the airship is the airship. This is the airship  
 of the airship is the airship.



Below the airship is the airship which  
 this is the carrier of the airship  
 of the airship is the airship. This is the airship  
 of the airship is the airship.



A workman giving the airship a  
 touch of paint. This is done to  
 keep the airship as clean as possible  
 the temperature of gas in the envelope

Below the airship is the airship which  
 this is the carrier of the airship  
 of the airship is the airship. This is the airship  
 of the airship is the airship.

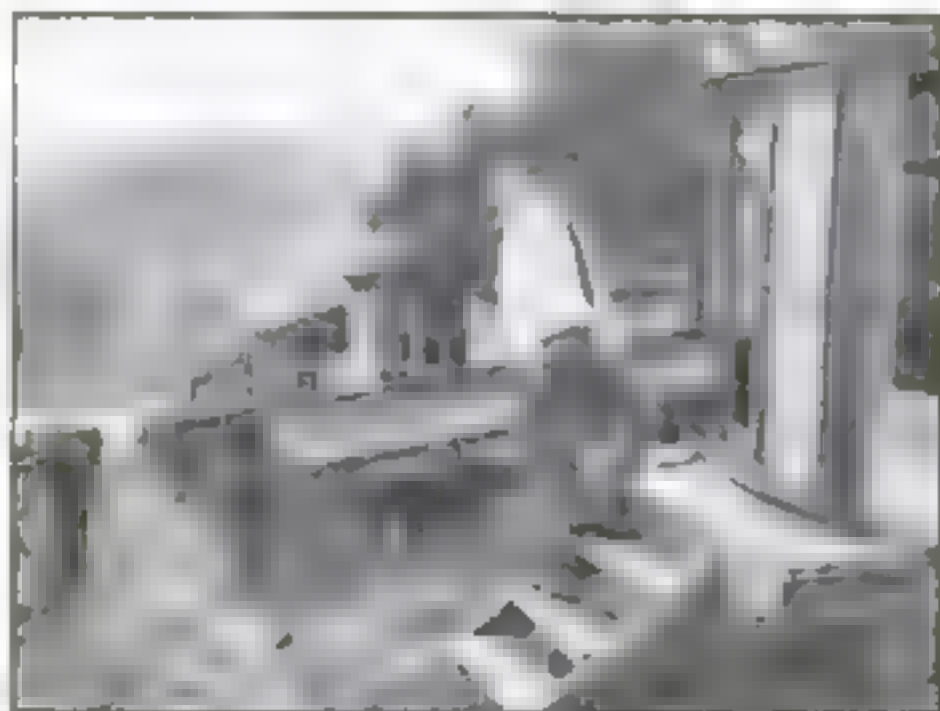
# Wild Turkey Paradise

*Saves Our Famous Bird*

By  
ROBERT  
E.  
MARTIN



On the wild turkey preserve in Maryland the hunter is permitted to kill only four birds a year. Photo shows sportsman who has bagged his four turkeys.



**I**N THE wooded hills along the Potomac River in western Maryland the wild turkey with the aid of one courageous sportsman, is making a last determined stand against extinction. The turkey, like the bison, was slaughtered ruthlessly by early hunters and has disappeared entirely from many areas. But, because of the vision of one man, extinction is no longer a serious threat.

Safeguarded on a 6,000-acre tract of woods and rolling fields, the turkeys have multiplied rapidly. Each year hunters privileged to shoot over the preserve, bag 1,000 of them. An additional 2,500 are shipped all over the country, and even abroad to propagate their kind. Yet, despite these inroads, there are today 25,000 wild turkeys on the preserve.

Creation of this singular haven has been the work of thirty-five years. Since 1894 Henry P. Bridges, the sportsman who conceived the project, has devoted his life to the work. Others, before Bridges, had tried to raise wild turkeys in captivity and had failed. The natural temper of the turkey, the depredations of rodents, and the ravages of disease made the attempt a source of constant disappointment.

**B**RIDGES had been a hunter and nature lover since boyhood. It disturbed him to find that wild turkeys had been practically annihilated in Maryland. The time was not long past when hunters in that state, in Virginia, and the Carolinas had slaughtered them by the thousands. Slaughtered is the right word, for the hunters first trapped the birds and then shot them from blinds. It was a regrettable state of affairs and, old hunters told Bridges, nothing could be done about it. But Bridges

had the vision to carry out his undertaking. Morning after morning he got on his own and took to the woods to study habits of the turkeys. Seemed by to cover he would summon the birds with a turkey call and study their manner and nesting habits and they ate. He had the wild turkeys by the time of the common poultry yard.

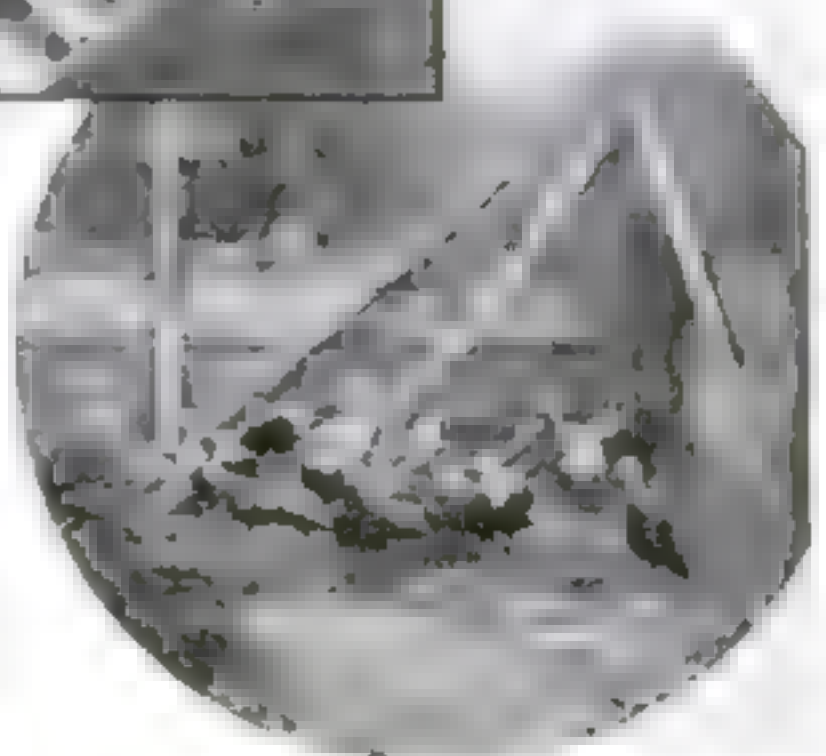
He found, for example, that a diet of grain would never do. The wild turkeys demanded a generous supply of spiders, grasshoppers, crickets, snails, beetles, and caterpillars. The U. S. Biological Survey corroborated his findings. Gizzards of wild turkeys showed that their diet consisted of fifteen and five-tenths percent animal matter and eighty-four and five-tenths percent vegetable.

When he believed he had thoroughly mastered his problem, Bridges, with a homemade trap of chicken wire, took two gobblers and two hens. Choosing a large farm near Hancock, Md., he began his breeding experiments. He was striking out into an entirely new field with no experience to draw upon except his own studies

in the woods and no rules to guide him except his own common sense. By the painful and sometimes discouraging method of trial and error, he evolved his own system of hatching and brooding and developed his own feeds and his own means of keeping the turkey houses and ranges sanitary.

The flock increased, for Bridges, gaining experience, found that raising the younglings was not an insuperable problem. By selective breeding, he improved the quality of his stock and before long he was in position to send young turkeys to private and public game preserves.

Once he had demonstrated the practicality of breeding the wild fowl domestically, he found that sportsmen every-





Henry P. Bridges, savior of the wild turkey, is shown inspecting a few of the thousands of wild turkeys he has successfully bred in captivity

where enthusiastically supported the work. Conservation societies, hunting clubs, and private land owners snapped up the young turkeys as fast as Bridges offered them. The farm at Hancock became famous wherever wild turkeys were known.

It was then that the Woodmont Rod and Gun Club asked Bridges to move his breeding stock and equipment to the club's preserve. Bridges had been a member of the club for years and was active in its affairs. Sensing an opportunity to broaden

the scope of his work, he accepted the invitation.

The Woodmont preserve was one of the finest in the country. It embraced 6,000 acres of some of the most picturesque country in the east. The club had been founded in 1870 by Rear-Admiral Robley D. (Fighting Bob) Evans. Sometime earlier Evans had accepted the invitation of a Maryland mountaineer to hunt over the hills along the Potomac. The mountaineer showed Evans a wooded plateau between Sideling Hill Mountain and Ronoloway Ridge that was as near to being a hunter's dream as Evans ever hoped to see.

At a banquet in Washington, Evans showed some of the turkey and venison he had secured. The guests were not only not bored but the banqueters went wild over it. Evans fanned their enthusiasm with glowing tales of his experiences. As a result of his propaganda work the Woodmont club was formed. On its roster were cabinet members, congressmen, capitalists, business men, and Army and Navy officers. The tract on the Potomac was bought. For years the only club house was a log cabin that had been used by Washington while on his survey for Governor Fairfax of Virginia.

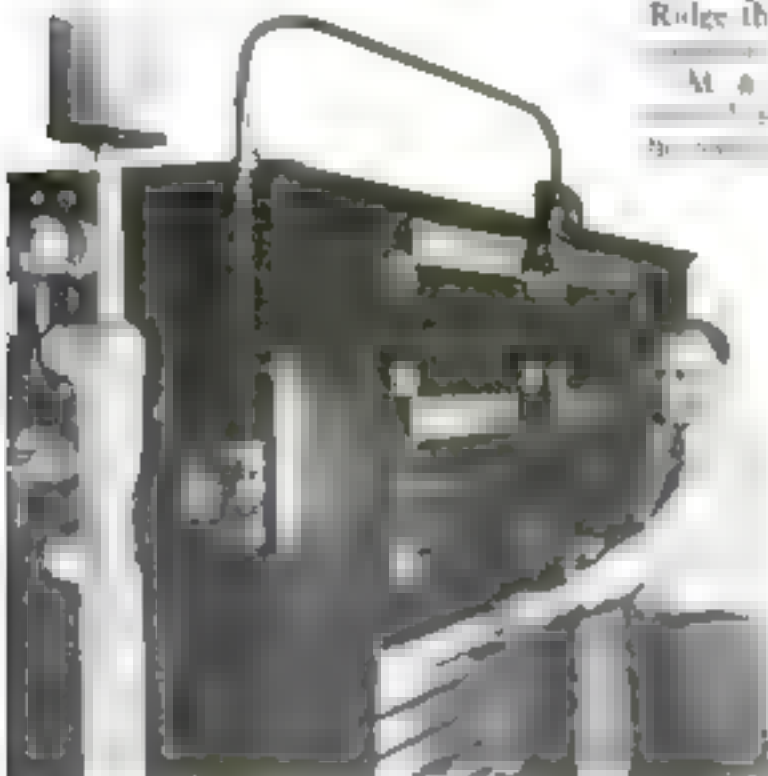
The club was destined to become one of the wealthiest in existence. Its sixty members, before the depression, were reputed to be worth \$300,000,000. Five presidents

have tramped through its forests and President Roosevelt was to have spent a few days there last fall. Its present clubhouse, modestly called a lodge, is a veritable palace.

No such luxury marked the club when Bridges moved his wild turkey flock over from Hancock. The log-cabin clubhouse had recently been burned and a reorganization of the membership was to be attempted. Plans were made for a new clubhouse and the preserve was enclosed. Fourteen miles of fence were built, an undertaking that took twenty-five carloads of wire and 4,000 locust posts. The fence was nine feet above ground and extended eighteen inches into the ground to bar the entrance of burrowing rodents.

For the first several years, hunting turkeys on the preserve was forbidden, and the ban was not lifted until the birds in the flock numbered 400. Then the original flock was freed and hunters for the first time were permitted to shoot them. But several stringent restrictions were imposed. The bag was limited to two turkeys on any one day and to four birds for the season. It was further stipulated that hunters using pump guns should carry not more than two shells in the chambers of their guns. This restriction placed them on an equal footing with the men hunting with double-barreled shotguns.

The liberated birds at first found their freedom a temptation to desert the preserve. They spread rapidly over the countryside but soon discovered the error of their ways. The neighboring woods offered no such luxurious (Continued on page 109)



In this electrically heated incubator, pheasant and quail eggs are hatched at Woodmont. Its capacity is 10,000 eggs

# Powerful Gas Weapons

*Police Borrow Methods of Chemical Warfare to Bring Tears to the Eyes of Desperate Criminals and Control Mobs and Industrial Rioters Without Real Bloodshed or Serious Injury*



Above, chemical grenades and candles of various types. At the front is a fragmentation grenade included for comparison. The gas (tear) grenades shown in the center is designed to be carried conveniently in the pocket by policemen. At left, an officer armed with a gas riot pistol, advancing behind a bullet-proof shield of the type now used by policemen.



Above, a new police weapon that combines the traditional billy with a tear gas gun. Left, tear gas, released by an automatic device, pours from a safe and flows onto the floor around it to foil burglars. The heat of an acetylene torch, or tampering with the lock of the safe, releases a stream of gas. Many banks and postoffices now use this device.

**P**ERHAPS you read, not long ago, about the spectacular ending of the careers of two notorious criminals, Harry and Jennings Young. Wanted for a number of murders and other crimes, the two men were trapped in a house at Houston, Texas. Police officers, surrounding the house, threw several tear-gas grenades into the building. A few minutes later they entered and a search revealed that the desperadoes had barricaded themselves in the bathroom. When an attempt was made to force the door, the trapped men opened fire.

"We're dead. Come and get us," one of them called out. At the same instant of time, officers shot tear gas through the bathroom window. Almost immediately the sound of pistol shots came from within the room. After the gas had been given time to act, police opened the bathroom door and found one of the men dead and the other dying. Rather than surrender to the overpowering gas and the law, the criminals had shot each other.

Contrast this with a scene that had taken place a short time before in Missouri. There the Young brothers had barricaded themselves in a farmhouse. A group of officers, armed with the usual pistols and with a small quantity of tear gas, surrounded the house. Because of an insufficient amount and improper use, the gas contributed nothing towards subduing the criminals. In the fighting that followed, six officers were killed and several wounded. While reinforcements were being obtained, the two desperadoes escaped.

This bit of recent history serves to illustrate the effective way in which chemical warfare can be used against armed criminals. But tear gas and other chemical substances are not used merely in the war against gangsters. They are employed in the bloodless subduing of mobs, protection of valuable property locked in safes, repulsing of vicious dogs, and safeguarding of the home.

Such gases supply peace officers with a humane method of making people behave. They cause no permanent injury and reduce the necessity for the use of firearms with consequent danger to innocent bystanders, including women, and children. Even bullets often fail to halt a highly enraged mob, but there is no record of a rioting crowd that failed to heed the relentless effect of an adequate quantity of tear gas or one of its more powerful brothers.

The use of the so-called non-lethal or non-killing gases is a phase of chemical warfare that developed directly from the World War. Although chemical warfare, as applied to peace-time control of crime and protection of property, is new to most persons, the idea of using chemicals as weapons is an old one. At different times for more than 2,000 years,

# Aid War on Gangsters

By  
WALTER E. BURTON

Oriental peoples have employed various chemicals in fighting. The finely ground pepper of the Japanese and the stickpoets of the Chinese are the ancestors of the modern gas grenades and guns. Various armies have used sulphur, Greek fire, and similar means of chemically attacking or repulsing their enemies. During our own Civil War, sulphur flames were used for a gas attack in the siege of Charleston, and shells containing Greek fire were dropped on the city.

In the afternoon of April 22, 1915, British and French soldiers saw a heavy, greenish cloud rolling ominously towards them. It was chlorine gas, released by the German army. This was poison gas, regarded by many military experts, who point to comparative figures between gunshot and gas attacks, as the most humane weapon ever developed, added to the world's armament.

About 1919, army chemical officers began to consider some of the non-poisonous war-time gases as possible weapons for use by law-enforcing officers in time of peace. As a result, the modern non-lethal gases, which have come to be associated with riots and other violence, have been given a prominent place in police equipment.

Chemical agents suitable for law enforcement can be divided into three groups. The mildest agent is Hexachloroethane or "HC," a few ounces of which, mixed with certain inorganic compounds, will produce more smoke than a million pipes of peace. HC mixture generally is employed in hand grenades, rifle grenades, and candles. The dense smoke, which blots out everything that it surrounds, has a sweetish smell, is harmless to the person encountering it, and does not make the use of a gas mask necessary. The laying of smoke screens is becoming recognized as a valuable tactical operation by police and military organizations. Behind a smoke screen, for instance, officers can approach a house containing barricaded criminals, and then can pour bullets or gas into the building. Any shots directed towards the officers will be random and hence seldom effective, as the criminals cannot see their targets.

Tear gases, or lachrymators, are, as their name indicates, intended to induce violent weeping. The abundant flow of tears causes temporary blindness; and such blindness interferes considerably with whatever it was the victim intended to do. Some tear gases are capable of producing blinding tears when they are present in only one part of gas in 10,000,000 of air.

Chloroacetophenone, or CN, a white, crystalline solid similar to granulated sugar in appearance, is the chemical usually employed in tear-gas grenades, candles, and guns. In addition to inducing violent weeping, it is, in



Gas can be used effectively at long ranges. Here an officer is firing with a gas 'field gun' at a building across the street.



Soldiers advancing against rioters behind a barrage of tear gas, which is now considered the most humane way to quell disorders. At right, a small tear-gas projector that can be carried in the pocket and is loaded as shown.

Using a twenty-gauge shell, this tear-gas projector has a safety ring to bar mishaps.



An aerial bomb for scattering tear gas. This might be used effectively in civil disorders.

concentrated amounts, painful to the skin. Discovered in 1877, this compound was not developed into a practical tear gas in time for use in the World War. It is a remarkably stable substance. It is capable of withstanding high temperature, does not corrode metal shells or grenades containing it, and is not affected by moisture. In its work of producing tears, it acts as a finely divided solid, like so much super-pepper. It is distributed by means of shells containing small amounts of explosive, or by means of candles or burning-type grenades. Solid CN particles have the pleasant odor of locust blossoms. This tear gas produces violent weeping and skin itching. For protection against it can be provided by tight-fitting goggles and cellulose pads held over the nose and mouth.

When CN is dissolved in chloroform, benzene, chloropicrin or other solvent, it becomes a more powerful producer of tears. CNS, as this form is called, no longer smells like a locust tree in bloom but instead produces a violent, biting sensation in the nostrils. Besides producing tears in overwhelming quantities, it causes severe irritation of the nose, throat, and skin. The best gas mask is necessary for complete protection. Shells, and hand and rifle grenades of the explosive type, are used to disperse CNS.

**I**F TEAR gas, or CN solution, fails to stop the mob, or if the person being dealt with is a dangerous criminal, there remains still a more severe chemical that the modern law-enforcement officer can use. This is an irritant smoke. The substance most commonly used boasts the name of Di-phenylaminechlorarsine. To save breath, chemists have abbreviated this to DM or KO. In pure form it is bright yellow, and in the crude form, green.

Like Chloroacetophenone, this compound was not developed in time for use in the World War, although the Germans knew how to make it in 1913. In solid form, it has almost no odor, but when distributed through the air in the form of finely divided particles or smoke, it smells like smoke. The victim has little time to appreciate this odor, however, for the compound causes a violent burning of the throat and nose, followed by sneezing,

coughing, vomiting, and prostration. A splitting headache lasting for several hours may develop. The effects of KO gas usually last for half a day, whereas the effects of ordinary tear gas may last for only a short time. Irritant smoke is dispersed by means of candles, which are thrown like hand grenades. The best commercial gas mask, equipped with a mechanical filter, is needed to provide protection. Even then, the gas may cause a skin rash when present in high concentration.

**P**ARTICULARLY effective are the gases that are a combination of tear gas and irritant smoke. No one who lacks a suitable gas mask can withstand such a combination. Yet in a comparatively short time, the person unlucky enough to come in contact with the gases will recover.

A considerable array of weapons has been developed for use of tear gas and similar non-lethal chemicals. Perhaps the most-used gadget for dispersing tear or similar gas where it is wanted is the chemical grenade. This consists of a metal container filled with the material, accompanied by an explosive charge which is set off by a firing mechanism, or a material that burns and releases the gas. As long as the grenade is not in use, a safety pin prevents the firing mechanism from operating. Just before the grenade is hurled this pin is pulled out. A spring then throws the lever off and causes a firing pin to strike the primer, igniting a fuse, which burns for a brief interval before the main charge is fired.

Explosive grenades usually contain CN dissolved in a liquid which causes irritation to the throat and nose, so that, together with the action of the tear gas on the eyes, a three-point attack results. Such

gas grenades are effective instantaneously.

Burning grenades require several seconds or minutes to deliver their load of gas. Smokeless powder mixed with CN produces one form, the powder acting as fuel. Another combination is CN with the HC smoke mixture, which acts as a screen as well as a tear-producer. A third form of burning grenade is filled with the harmless HC smoke mixture, and is used solely for screening purposes.

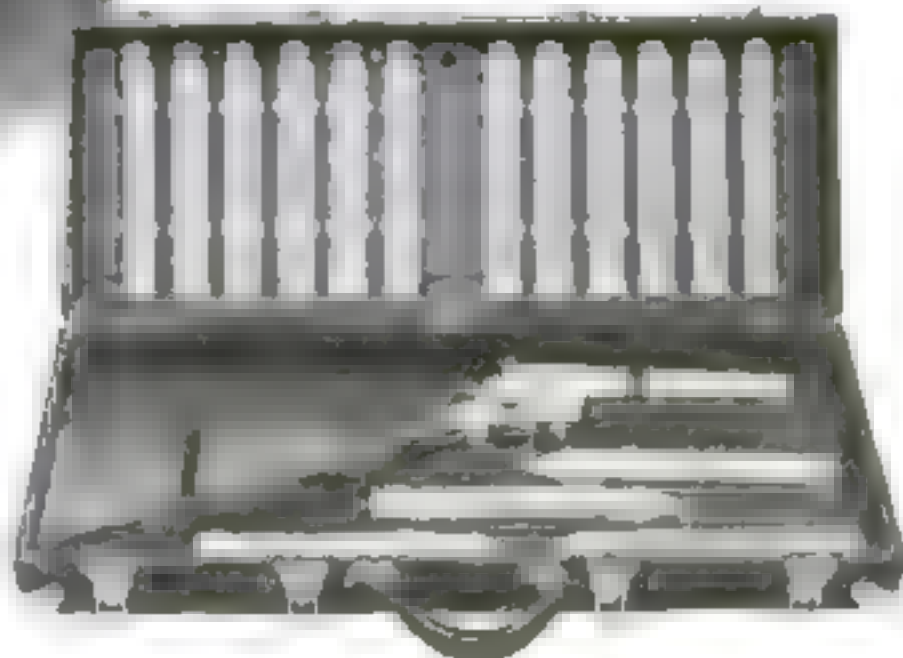
A close relative to the gas grenade is the chemical candle. The candle now in general use was developed not long ago by the Chemical Warfare Service. It consists of a cylindrical metal container measuring five and three quarters by two and three eighths inches and equipped with vent holes that are opened by the action of the burning material inside. This fuel is mixed with tear-gas material. A standard candle burns about three minutes, while a quick-burning type discharges its gas in less than thirty seconds. Either tear gas, irritant smoke, or a screening smoke can be used in such candles. Candles contain up to five times as much gas-producing material as hand grenades. Unlike some grenades, the quick-burning candles cannot be picked up and thrown back at the original thrower. This is because there issue, through numerous holes in the top and along the sides of the steel container, blasts of hot gases that make it impossible for anyone to pick up the candle.

**V**ARIOUS types of guns have been developed for discharging tear gas. In fact an ordinary pistol, rifle, or shotgun of .38 calibre or larger can be employed to fire tear-gas shells. A shell smaller than .38 calibre cannot hold enough tear gas to be effective.

The Big Bertha of gas artillery is a so-called field gun that fires gas projectiles over ranges up to 450 feet. It is intended for use against criminals barricaded in a building, and under similar circumstances. The shell is one and one-half inches in diameter and ten inches long. The firing charge ignites a fuse in the projectile, which in turn causes an explosive charge to scatter the gas material at the instant the shell arrives at its mark. Short-range shells, for use over distances up to thirty-five feet, and long range shells for use up to 450 feet, are provided. The gun also can fire star shells, equipped with tiny parachutes, which illuminate the landscape at night, or *(Continued on page 104)*



Above, the business end of a gas gun that shoots either short- or long range shells. At right, a portable tear gas arsenal used by officers in long range attacks against barricaded criminals, or in defensive fighting at close quarters.



# Mysterious New Aircraft Powered by Reaction Motor

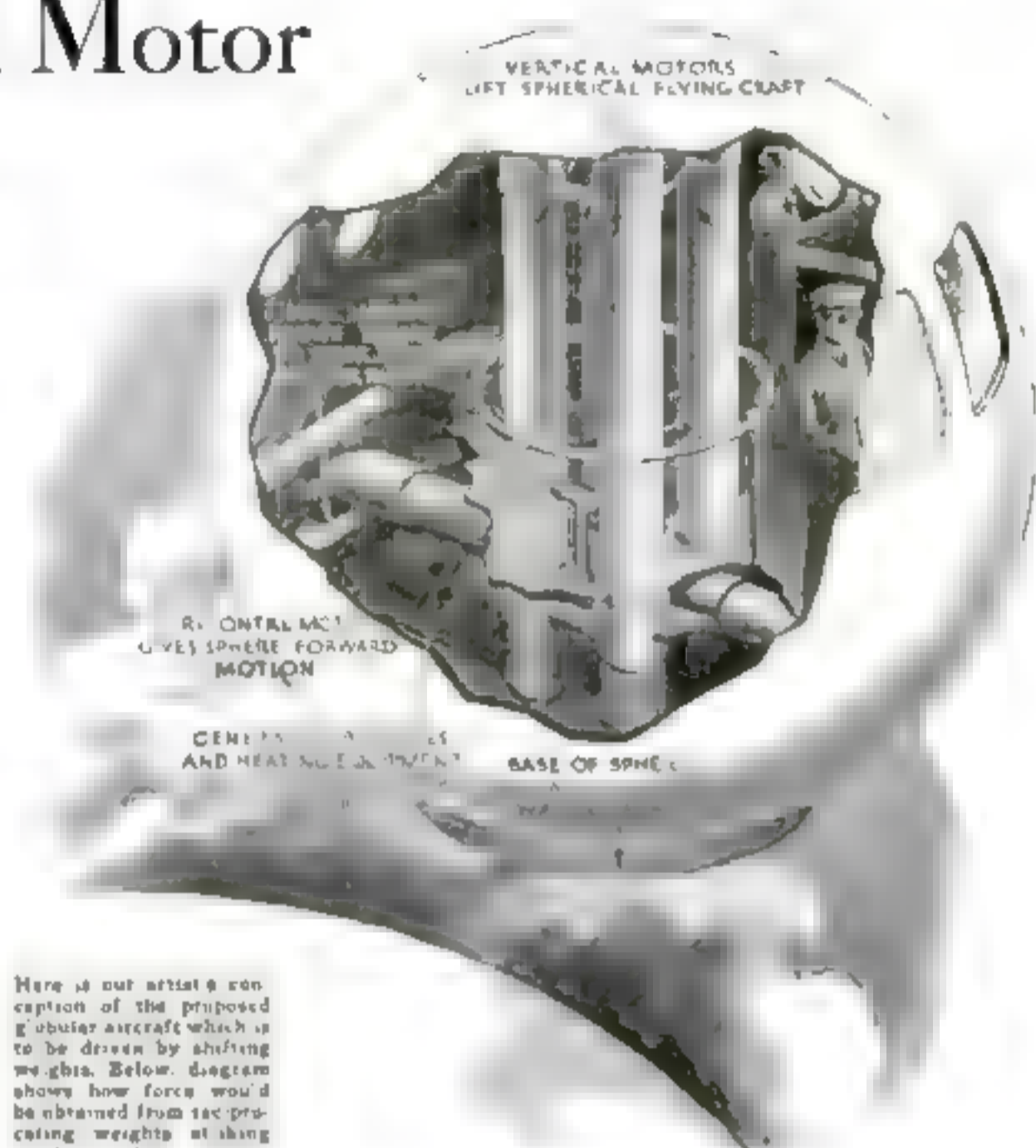
**I**MAGINE a heavier-than-air flying craft devoid of any visible means of propulsion, which rises from the earth and travels through the air in apparent defiance of the law of gravity. Lifting itself by its own bootstraps, by slinging weights about its interior it could navigate at will in the stratosphere or even in the unknown reaches of outer space. Such a craft is brought within the realm of speculation by pioneer experiments of Harry W. Bull, of Syracuse, N. Y., with an entirely new form of propulsion that he terms the reaction motor.

Suspended from a pair of light, flexible wires, in his laboratory, hangs a cylindrical tube about a foot long. At the touch of an electric switch, it becomes alive and leaps forward, as if drawn by some invisible magnet. Actually the power plant, a curious system of reciprocating weights, is contained within the tube itself.

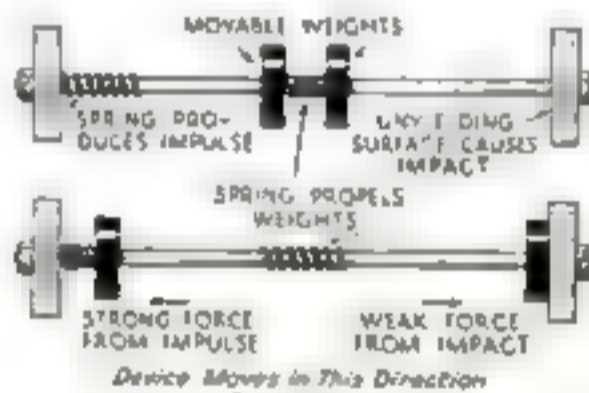
This elementary form of reaction motor operates on a principle that has long been neglected by engineers, but which Bull believes can be applied in aircraft and other vehicles. It depends upon the difference in effectiveness of two ways of transmitting energy, which can be termed impact and impulse. If a weight is thrown against a solid wall, it is stopped by impact, and much of its energy is wasted in distorting the weight and wall and in producing heat. However, if the weight is thrown against a spring fastened to the wall, it is stopped by impulse, the spring conserving the energy of the moving weight and transmitting the resulting force, with little loss, to the wall. Tests have shown a weight will yield three times more force by impulse than by impact.



Harry W. Bull, Syracuse, N. Y., inventor exhibits an experimental model of his reaction motor with which he hopes to power an aircraft that will, apparently, defy gravity. When the power is shut off the two pointers, above, coincide. Weights in the device are operated by electromagnets.



Here is our artist's conception of the proposed globular aircraft which is to be driven by shifting weights. Below, diagram shows how force would be obtained from reciprocating weights striking against the springs.



Applying this principle in the manner shown in the accompanying diagram, he mounts two movable weights in a cylinder and starts them simultaneously in opposite directions. One is stopped by a flat steel plate, and the other by a spring. The difference in the effectiveness of the two blows, as explained above, is sufficient to kick the cylinder forcibly in the direction of the spring. The weights may be returned to their original positions by any standard mechanical means, and the cycle repeated continuously, providing a steady and self-contained driving force without recourse to propellers, rocket jets, or any other familiar means of propulsion.

From the present experimental model to a reaction motor powerful enough to lift aircraft seems a long step. Achieving a

practical reaction motor, Bull points out, depends to a large extent, paradoxically, upon how inefficient it can be made. The more force that can be wasted in impact, the greater force will be left to push ahead, a new problem for engineers, who have spent years trying to conserve energy rather than dissipate it. Likewise, much experimentation remains to be done upon the impulse side of the apparatus, which is still far from efficient.

Supposing these difficulties overcome, what would an airship, driven by a reaction motor, look like? Bull visualizes a globular craft with a motor in the form of an upright cylinder containing two pistons operating in opposite directions, one delivering an impulse and the other no impact. A carburetor adapted for mixing vaporized oxygen and gasoline would supply an explosive mixture to drive the pistons. Several cylinder units could be used to obtain a steady lifting force. Others placed horizontally would provide forward motion. A similar impulse-impact cylinder of reduced size, operated electrically and mounted near the outer shell of the ship, would rotate the craft for steering. An airship driven by this new method could travel at high speed and could be used at either high or low altitudes.



## USE HIGHEST SCAFFOLD TO CLEAN MONUMENT

SO WORKMEN may give the Washington Monument, at Washington, D. C., its first cleaning and overhaul since it was completed fifty years ago, the 555-foot shaft has been encased in the highest continuous scaffold ever built. Standing on planks laid across the steel framework of the giant scaffold, workmen will cut away all weakened mortar. The joints, thus exposed, will then be filled with fresh mortar and the Monument will then look like new.



Above, throwing an arrow with Mayan huil-che hook. Inset, a close-up of such

## NEW FAD IN SPORT BASED ON ANCIENT INDIAN GAME

THROWING arrows with the huil-che, a weapon used by ancient Mayan hunters has been revived in Los Angeles, Calif., as a new sport. Discovered by a noted archeologist in Mayan ruins, the huil-che is a short stick with a hook at one end, and a grip with two finger holes at the other. In position for discharging an arrow, the hooked end rests against the feathered end of the arrow, the shaft of which lies across the fingers of the thrower's hand. The stick is in effect an extension of the human arm.



Above, Washington Monument being encased with scaffold built up around it from bottom to top. At right, workman standing on plank at the very top of the Monument 555 feet high

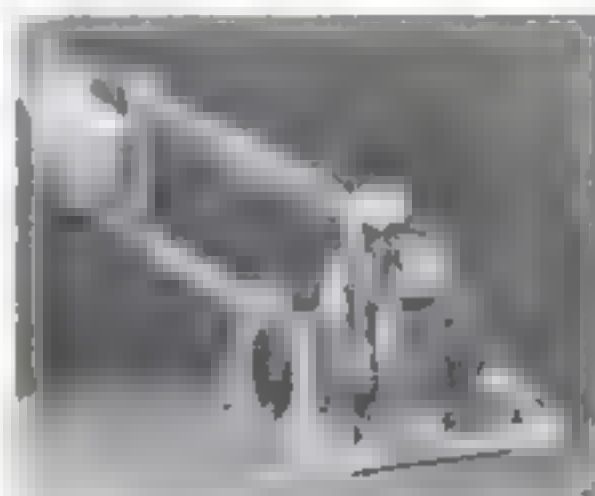
## BULL BAILS OUT IN PARACHUTE

RUSSIAN circus clowns in their acts of a new type of acrobatic novelty. In a recent performance, a bull was served. With the parachute tied around him he was dropped out of a lumber at a height of several thousand feet. When he touched the ground he took off across the fields in terror.

## HOTEL LIGHT SIGNALS ARRIVAL OF MAIL

EACH guest in a large Chicago hotel is notified instantly of the arrival of mail by a sorting rack that automatically causes a green light to flash on in his room. Each of the cubbyholes in the rack contains a metal flap that hangs vertically when the hole is empty. When a letter is inserted, this flap is pushed up, completing an electrical circuit and switching on the light in the room of the guest to whom the mail is addressed. By pushing a button, the guest may notify the bell captain that he wishes the mail delivered by bellboy in his room.

Below, panel over hotel bell captain's desk that shows light when a guest wants his mail



## TUBING CUT OFF SQUARE WITH NEW TYPE VISE

CUTTING perfectly square ends on thin copper or brass tubing, without crushing or marring, is made easy by a vise recently placed on the market. All sizes of tubing from one eighth of an inch to two inches are quickly locked in place by means of a reversible vise block and thumbscrew. A saw guide keeps the blade running in a straight line, assuring an accurate right-angle cut without chipping or distorting the end. The vise is made of aluminum with steel inserts to increase its strength and insure the durability of the tool.

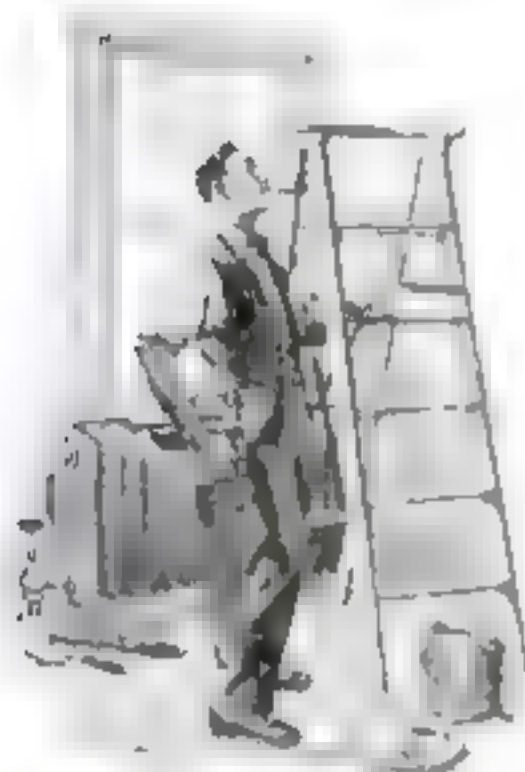


Above, light that automatically goes on in room of hotel guest when there is mail for him. Right, rack that gives signal of mail

# Handy Man

**I**N AN AGE of Specialization  
When each of us labors at  
A part of an operation  
And doesn't know more than that,  
When everyone's concentrating  
As narrowly as he can,  
I choose to be celebrating  
The General Handy Man!

Who can paint and plumb  
By the rule of thumb;  
Mend a roof with tar  
And tinker a car,  
Mix concrete,  
Build a garden seat  
Or solder a leaky can,  
The highly efficient  
Nearly omniscient  
General Handy Man!



By  
**BERTON  
BRALEY**

When a Doctor's life long mission  
Is Noses—and nothing else!  
When a Scientist's whole ambition  
Is to study the tails of smelts!  
When each of us seems to yearn to  
Be a cog in the Cosmic Plan,  
It's rather a joy to turn to  
The General Handy Man!

Who can paper a room,  
Make a garden bloom,  
Mend a screen  
Or a mowing machine,  
Make a radio talk  
When it seems to balk,  
Make a battery work  
When it tries to shirk,  
Fix a chimney flow  
So the flue will draw—  
Oh it's quite a relief to scan  
This skilful jack  
Who will take a crack  
At any job, with the  
versatile knack  
Of the General Handy Man,  
The smart and sensible  
Indispensable  
General Handy Man!



## MAN-MADE WINTER TESTS INSULATING MATERIAL

To test the ability of his product to withstand rigorous temperatures, a manufacturer of building insulation produces his own winter in his own laboratory. The weather-making room is a simple cell in which artificial refrigeration creates winter temperatures down to five degrees above zero. One wall of the room is pierced by a three-foot square opening. This opening, when a test is under way, is covered in turn by standard building materials such as brick and wood and special insulation materials. Electrical devices attached to the outside of the wall show the amount of heat escaping.

## FIREMEN START BLAZE

NEW YORK CITY fire-fighters set fire to a tenement building recently to get it out of the way of a tunnel. This gave them a chance to test a sprinkler system and several types of fire-retarding walls. Three engine companies were ready to check the flames had they spread too far.

## LIGHTS ON BICYCLE PEDALS

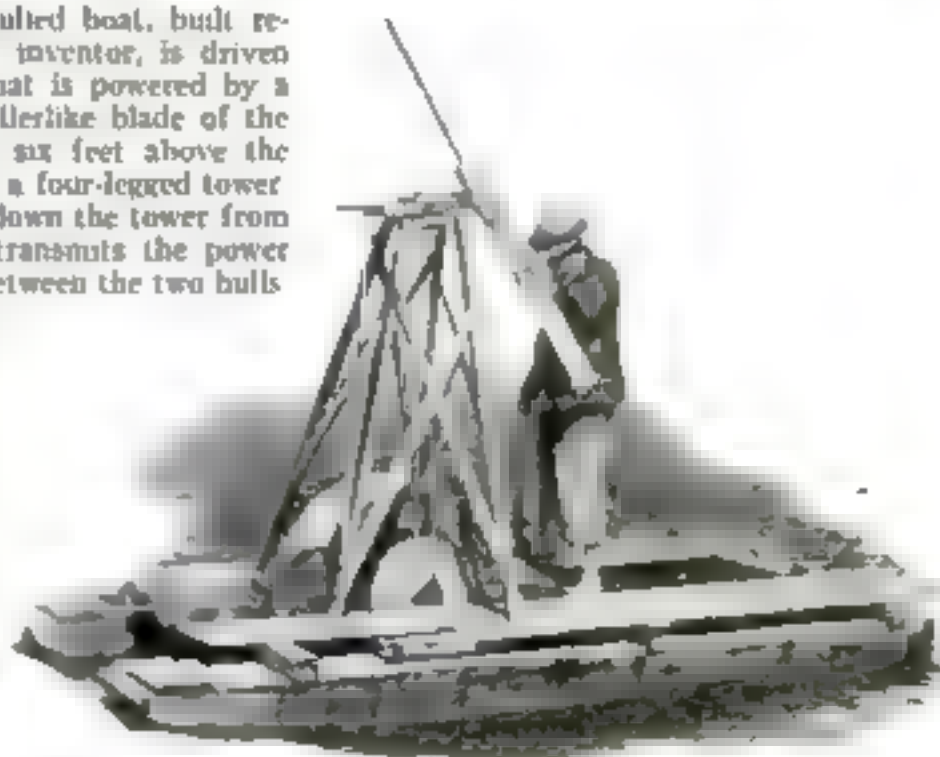
TRYING to reduce the dangers of night cycling, an English inventor has developed a pair of moving tail lights to render cyclists more readily visible to motorists coming up behind them. The lights consist of red reflecting lenses fixed in short blocks, one of which is bolted to the underside of each pedal of the bicycle. The lenses are thus kept in motion by the pedaling of the cyclist, remaining stationary only so long as he is coasting. They arrest a motorist's attention quickly, and tell him that it is a bicycle he is overtaking.



Reflectors on bicycle pedals warn motorists

## WINDMILL ON DECK RUNS STRANGE BOAT

A STRANGE, twin-hulled boat, built recently by an Oregon inventor, is driven by a paddle wheel that is powered by a windmill. The propellerlike blade of the windmill is mounted six feet above the decks of the craft, on a four-legged tower. A rope belt, running down the tower from the propeller shaft, transmits the power to the paddle wheel between the two hulls. With the pulleys geared down, the boat can be propelled at fair speed in even a light breeze. The unusual craft is steered by a rudder attached to the planking that connects the twin hulls at the stern. The tiller, rising about three feet above the decks, can be operated by a standing man.



The paddle wheel of this unusual boat is run by the windmill seen on deck

## FINGER PRINTS SOLVE ANCIENT RIDDLE



FINGER prints made 3 000 years ago are being used to determine the age of pottery recovered from what are thought to be the ruins of the old city of Megiddo in Palestine. Archaeologists usually assume that an article recovered at a lower level than another is older than the latter. The finger prints on the earthen jars by ancient potter have shown that, in the case of this particular find, the same worker fashioned objects found at various levels.

## ROBOT EXERCISES ARMS OF BOXERS

A MECHANICAL training device that teaches a boxer to move his arms straight and fast has been invented by a Pennsylvania shoemaker. Two handles, powered by an electric motor, fly back and forth at terrific speed while the boxer hangs on to them. According to the inventor, this develops the boxing muscles. In the photograph at the right, he is demonstrating his machine.



Left: natives of Megiddo, 3 000 years ago, are thought to have used the same worker to fashion objects found at various levels.



## SLOT MACHINE VENDS CONCENTRATED SUNSHINE

For those who cannot afford a trip to sunnier climes, an automatic vending machine provides what is said to be the equivalent of a day's exposure to sunshine at the beach. Dropping a coin in a slot turns on an artificial sun-lan lamp, before which the customer may bask for seven minutes before the lamp automatically shuts itself off. As a precaution against an overdose, a printed notice on the machine warns the user against another treatment inside of three days.

## WATERS POTTED PLANTS WITH SANDSTONE WICK

A stone wick that waters potted plants has been tested with success by Prof. B. E. Livingston of Johns Hopkins University, Baltimore, Md. The rod, made of fine-grained artificial filtering material resembling porous sandstone, is placed in the pot with one end extending down through the hole in the bottom in a pan of water. This wick carries up just enough water to keep the plant healthy.

## DAIRY EXPERT HAS FURNITURE HOBBY

THE problems of dairy farming which engross K. E. Parks during the hours he spends in the Bureau of Dairy Industry at Washington are displaced from his mind during leisure hours by problems such as that of turning a leg for a piece of period furniture. Parks is only now getting into his full stride as a creator of fine furniture and ship models. Heretofore, much of his time has been occupied with equipping the shop beneath the porch of his home. The jig and circular saws, the bench lathe, the drill press and other pieces of equipment were not only designed by Parks but built by him. A single item, a drill press, saved him \$300, the amount it would have cost if purchased commercially. A drawing board is conspicuous among the equipment. It is upon this that the details of everything he builds is first set down by this methodical hobbyist. His plans for the future include the building of unusual furniture.



K. E. Parks at the back-gear lathe he designed and built himself.

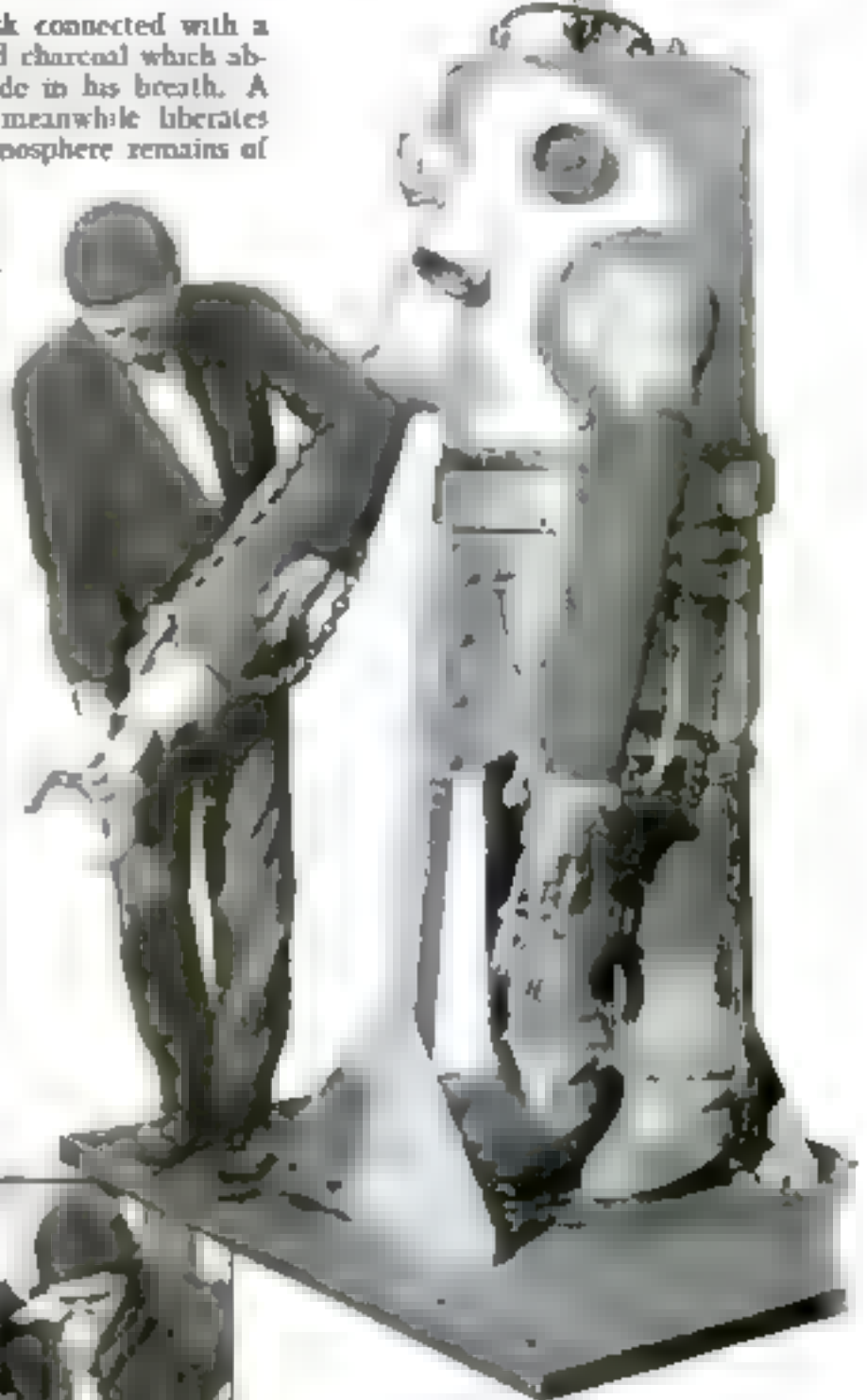
# New Suit Aids Divers' Quest for Gold

INDEPENDENT of air supply from the surface, a grotesque diving suit recently perfected, is expected to carry a marine salvager down 2,500 feet, a depth hitherto impossible for divers. The body of the suit, enclosing the head as well as body, consists of two massive steel sections joined at the waist. Heavily reinforced rubber tubing is used for the arms and legs. Tools, such as claws, hooks and hammers, are attached directly to the ends of the arms and are operated by hand screws inside the sleeves. Powerful lights, bolted to the crown of the suit and to either arm, furnish illumination for work on the bottom. The suit contains a telephone for instant communication with the surface. While on the bottom the diver

exhales through a mask connected with a can of caustic soda and charcoal which absorbs the carbon dioxide in his breath. A flask within the suit meanwhile liberates oxygen so that the atmosphere remains of normal composition and pressure. Through these means the diver can work below water for four hours at a time without experiencing ill effects. As a result the diver can be raised to the surface without the delay necessary to give vent "bends," an affliction common with suits now in use.



Right, new diving suit in which worker may reach 2,500-foot sea depth. Left, diver in new suit ready to be lowered into East River, New York City in test of its operation. Below, diver in lower part of suit and wearing the mask through which he breathes during his submergence.



## COPPER RINGS PROTECT SEWER PIPE FROM ROOTS



TO PREVENT roots from entering a sewer pipe and clogging it, protective rings have been placed on the market for insertion in each joint between sections of pipe, as shown above. Made of copper, the rings are declared to last indefinitely. When hairlike root tentacles penetrate a leaking joint and encounter the ring, they are chemically poisoned and their growth in that direction is stopped, although no harm whatever, it is said, is done to the tree or plant to which they belong. The pipe, also, escapes all injury.

## ELECTRIC MOTOR POWERED BY SUNLIGHT



These plates are used to turn sunlight into electricity to run motor.

WHAT is said to be the first sun-powered electric motor constructed in this country has been completed by J. Thomas Rhamstine, Detroit, inventor. When sunlight falls upon a set of light-sensitive plates, shown at the center of the accompanying picture, it is transformed into electricity. A current flows between the front of the photoelectric plates, which is positively charged, and the metal back which is the negative pole. This current spins an armature.



Ants are not so small when you see them through the microscope. They are big enough to see with the naked eye.



# Ant's Strange Equipment *SEEN IN YOUR MICROSCOPE*



Foreleg of ant enlarged about 300 diameters. Note the comb with which the insect cleans its body. One part of the comb is like a knife blade against the leg when not in use.

**N**O MATTER where you go, you cannot escape the busy ant, except on the tops of the highest mountains and in extreme polar regions. You can find ants in the dry, hot desert or the steaming tropics. If you are like most persons, you have little love for them. Rather you notice them because of mingled feelings of curiosity and fear. They seem, as you watch them going about their busy ways, to be guided by a mysterious sort of intelligence and to possess a power that is a bit threatening to your personal comfort.

If you are a microscope hobbyist, the ant will appeal to you in another way. "Surely," you will tell yourself, "such an insect ought to have a few secret wonders that my magic lenses will reveal."

Put one of these creatures on a slide and look at it at even a low magnification of twenty diameters or so, and you will marvel at some of these wonders. An easy way to capture ant specimens is to hold the bowl of a teaspoon where one of them will crawl into it, moving the spoon about until the insect, which at first will attempt to run around it, decides to try a short-cut. Lift the ant and deposit it in a wide mouth bottle by tapping the spoon on the bottle edge. In the bottle can be denatured alcohol or a strong solution of carbolic acid. The latter which must be kept off skin and clothing, is preferred by some microscopists for killing insects because it renders them somewhat more transparent. Before dissecting or mount-

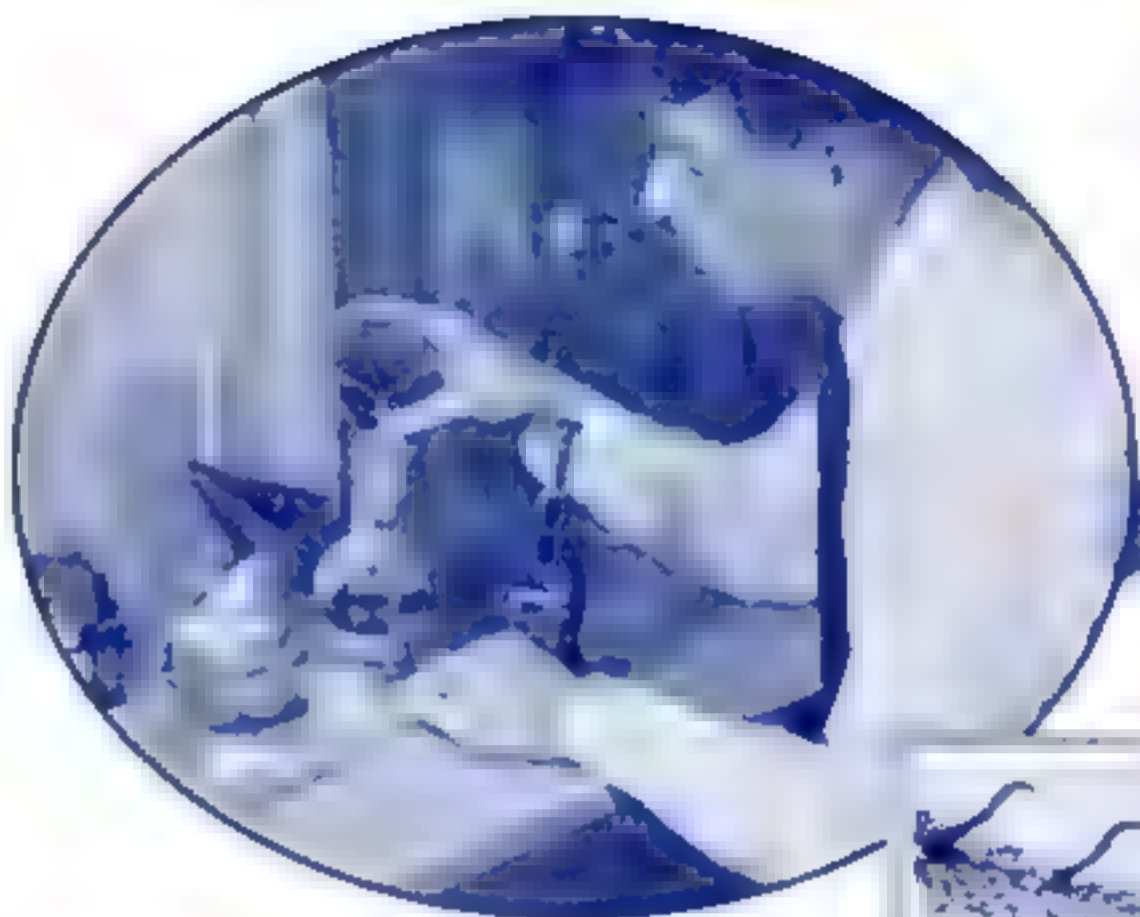
ing a specimen killed in the acid, wash it well in clear water.

You will find that black ants do not make as good microscope specimens as those of lighter color, such as red, because they are opaque to light. Small red ants that you can capture in any garden are sufficiently translucent to make beautiful objects when placed whole on the slide, either dry or in water, liquid petrolatum, or other medium.

Ants are outstanding social insects. The colonies are composed of different types of individuals, like colonies of bees and certain wasps. These form the highly specialized castes including workers, queens, and males. Only the queens and males possess wings at certain periods of their development. The female workers never are winged, and frequently are comparatively small in size. In some species, the queen is several thousand times larger than the workers of her colony.

Perhaps you have seen, on a still, sultry afternoon, winged ants swarming in the air. These are males and females on their honeymoon flights. As if by a pre-arranged signal, all winged inhabitants of hundreds or thousands of colonies take to the air at the same time. Later most of the females pick out new home sites which may be a hole in the earth or a tunnel beneath a stone, shed their wings and settle down to raise a family. From this time until the first brood is hatched, the typical queen does not eat or engage in other activity. Her massive wing mus-

In preparing an ant specimen for observation beneath your lens, it is dissected in a drop of water on a hot-low-ground slide as is shown in the illustration below



**PREPARING LIGHT FILTER** Colored water is poured into a flask which is held in a wooden stand which is built as described in the text of this article. Light passing through the flask of colored water and falling upon the specimen increases its visibility

cles, no longer required for locomotion because the wings have been discarded, are absorbed and converted into egg material. Individual ants in the first brood are small, because of the limited food supply. They assist their mother by bringing new food into the nest, so that the second and subsequent broods are made up of normal-sized individuals. A queen ant may lay eggs and raise families for many years. This life cycle is not followed by every ant species, but is typical of many of them.

Examine a winged ant under the microscope. You can see without much trouble that the wings, of generous proportions, require powerful muscles, so that the way in which the queen ant can exist without food while her first batch of eggs are developing becomes evident.

When you look at a worker ant, at moderate magnification, you will be struck by the well-poussed appearance of her body. The armor plate fairly glistens, with a finish rivaling that of a shiny motor car. Although your specimen spent much of its time in or on the ground, you fail to see particles of dirt on its body. Why is this?

**F**OR the answer switch to a somewhat higher power and examine carefully one of the fore legs of the ant. There, near the outer end of one of the sections (the tibia) is a delicately formed comb, with perfect rows of tiny teeth. It folds down, like a pocketknife blade, against the adjacent leg section or metatarsus, which likewise is toothed. Now you know how the ant keeps herself clean. She combs her body with her fore legs, drawing her other legs and antennae through the notch formed by the comb and metatarsus. Then she cleans the combs by passing the teeth through her mouth. She does not eat the dirt thus obtained, but snetracks it to a little pocket lying just inside the mouth opening.

In this pocket she also stores, tem-

By  
**MORTON C.  
WALLING**

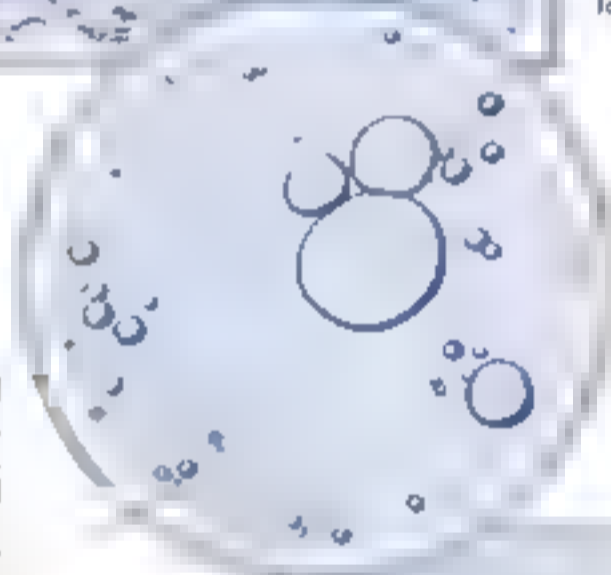
porarily, any solid food that she may have eaten. It remains there until all the juices it contained have been pressed out. Then the pellet, formed by compressing the food and dirt particles in the pocket, is discarded. The ant, therefore, actually does not eat solid food, but only liquids. Sometimes it finds these liquids ready to drink. At other times it has to extract them from solid material in the pocket, or by squeezing a bit of solid food between its powerful mandibles. By carefully dissecting the head of a large ant, you may be able to find the little pellet in the pocket just inside the mouth.

The head and mouth parts of ants vary according to species. Generally there is a prominent pair of mandibles, usually toothed. These operate somewhat like the jaws of claw-type pincers. The ant uses them as its principal tools much as you use your hands. With them it captures and kills other insects and presses their juices out for food; it tunnels through earth or wood, it uses them as weapons in fighting, it employs them as tongs for carrying eggs, young ants, and all sorts of objects.

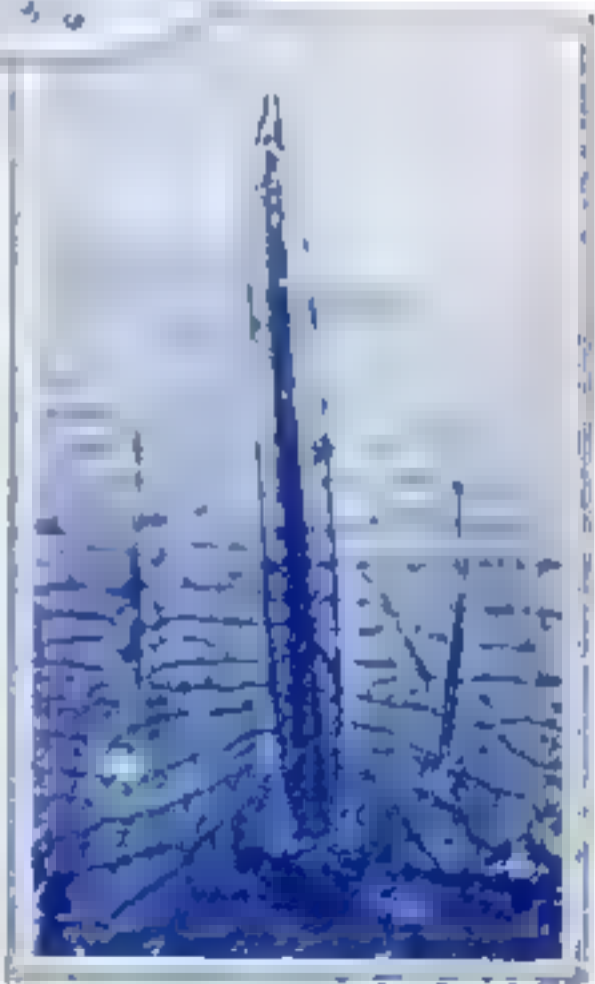
In addition to the mandibles, the mouth parts that your microscope will reveal include the upper lip, or labrum, lower lip, or labium, and a pair of maxillae. The labrum and maxillae are equipped with pairs of jointed palpi, which are sensory organs probably (Continued on page 94)



Left, magnified view of tiny hooks found along the front edge of an ant's smaller wing. These hooks fit into a groove in the rear edge of the larger wing as they lock wings together



Enlarged view at left of droplets of fat found in the body of a female ant. These furnish food during the winter period



The spike in the center of this picture is a hair on the body of an ant. It is magnified about 550 diameters. Note the ridged nature of the insect's body as seen in a microscope

# Giant Pincers Repair Road Torn Up by Quake

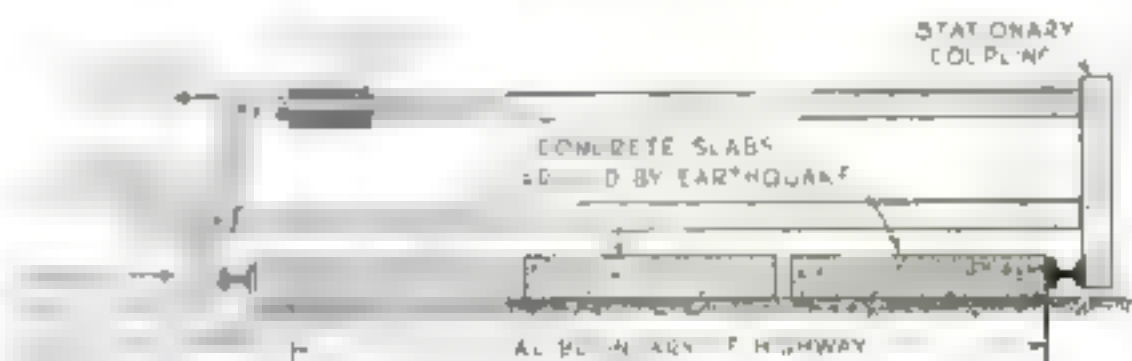


WHEN an earthquake played havoc with California highway some time ago, engineers faced a difficult repair job. To close the gaps, they devised a giant pair of pincers with jaws thirty feet apart. An hydraulic jack inserted in the upper jaw provided the force to operate the pincers, which were mounted on a trailer. To align a section of road, the stationary jaw of the pincers was jammed against one side, the pivoted jaw against the other, and the hydraulic jack set in operation. Under terrific pressure, the fifty-ton blocks of concrete slid back into place. Thus 3,000 feet of highway was realigned.



Above, working end of big highway realigning machine by hydraulic power.

Right, diagram



## OLD WAR TANK NOW LIGHTING STATION

IN ASHFORD, Eng. and, an old war tank finding a peace-time use as a local electric light plant's switching station. A central position was needed by the company and the town authorities gave them permission to use the tank if they did not change its appearance. The interior of the tank provides room for a small switch board and three high tension cables. As for its exterior appearance, the tank still remains as a memorial of the World War as not necessary to make outside changes making it a light station.



## GLASS DISKS STICK SOLIDLY TOGETHER

IN A striking demonstration of the accuracy with which optical glass can be ground, two pieces of such glass clung together so tenaciously that the weight of a 104-pound woman failed to separate them. The tenacity with which the pieces stuck together was due solely to the attraction of the molecules in one piece for those in the other. It was estimated that the pieces were capable of resisting a separating force of ninety-five to 100 pounds. The surfaces of the glass had been polished to within a hundredth of an inch of perfect flatness.



## NEON LIGHTS IN TUNNEL WARN MEN OF BLAST

LIGHTS of red neon tubing placed on curves in tunnels protect workers as they dig one mile of shafts being driven by the Metropolitan Water District of Southern California to serve as aqueducts. The glowing strips of light, which can be seen long distances, warn workmen of impending dynamite explosions, of which there are 2,000 daily. The photograph above shows one of the warning signals.

## WOMEN FLYERS TO GET FORCED-LANDING PRIZE

A PRIZE for forced landings has been announced by the president of the Ninety-Nine Club, American organization of women pilots. It is to be awarded each month to the girl flyer who lands at the greatest number of airports, successful forced landings counting two points and dead-stick landings made in pastures and fields, three. The purpose of the prize is to call attention to the nerve of women pilots in emergencies.

## The Man



CHEMICALS extracted from petroleum are so numerous the list fills a volume of 1,200 pages.

JACKKNIVES were used 1,000 years ago. In Germany, archaeologists have just uncovered a knife with a folding blade which they estimate is at least ten centuries old.

CANDY phonograph records have been patented in England. When you get tired of hearing the record, you can eat it up!



AMERICANS still buy \$300,000 worth of buggy whips each year.

MONTANA'S geographic center is in a kitchen sink. State surveyors seeking the exact center of the state, found the point was in the town of Lewistown, in the home of a doctor and in his kitchen sink.

SUNFLOWERS wake up at midnight. Records kept by scientists at the Boyce Thompson Institute for plant Research, Yonkers, N. Y., show that the cells speed up their work after the clock strikes twelve. For a while it was assumed that the sport in activity started at sunrise.



COLLEGE students are getting smarter. Out of 188 colleges, 157 report higher marks on intelligence tests now than before the depression began.

WORMS recently stopped a train in Texas. Tens of thousands covered the rails, caused the drive wheels to slip and brought the train to a halt.

GOLDEN EAGLES fly faster than two miles a minute. Timed over a three and a half mile course in the mountains of Scotland, one was observed to be making this speed, at the same time gaining 1,000 feet in altitude.

EIGHT hundred and fifty words are all you need to know to carry on an ordinary conversation.



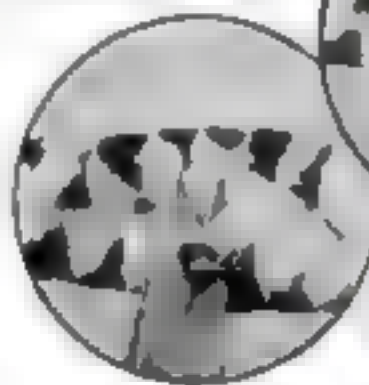
HEAT regulates the speed of ants. At fifty degrees F., they run fifty-two feet an hour, at 100 degrees, 750 feet an hour. By glancing at a thermometer, a Harvard scientist found he could tell within five percent of how fast an ant would be moving. And by timing an ant, he could determine within one degree how hot the day was.



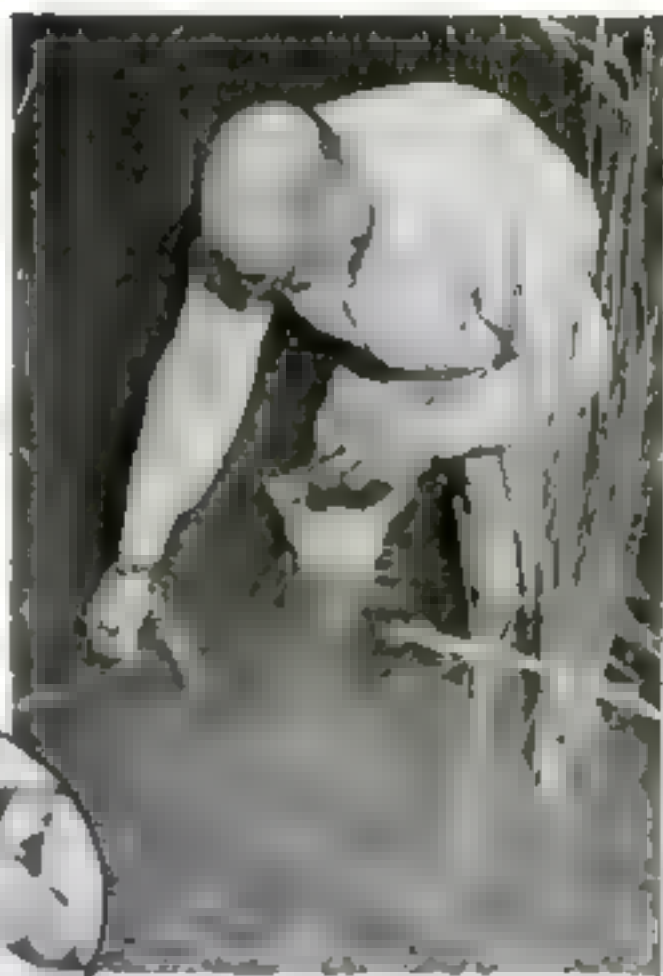
## SNAKES MARKED FOR STUDY OF TRAVEL

SO THAT the habits of snakes, particularly their travel, may be accurately studied, a Texas expert has devised a singular method of marking them. Instead of branding the reptiles, as is done with cattle, or banding them like birds and bats, this expert clips scales on the underside of their tails. The operation, accomplished quickly and without apparent pain to the snakes, leaves a permanent scar. Beginning with the second scale of the tail, scales are clipped from both the left and right sides. A card record is kept for each snake showing which scales were clipped on either side. Studies conducted thus far with marked snakes show that some remain in practically the same spot indefinitely, while others wander as far as four miles within two years.

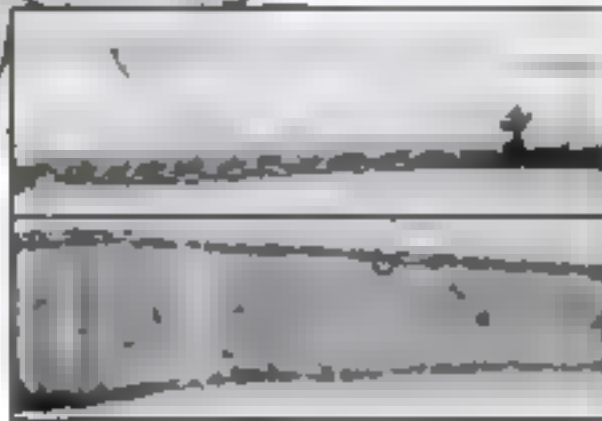
Right, how points of scissors are inserted to clip a scale on a snake for marking it.



Above, how the clip is completed. When it is done in the way the snake is unharmed.

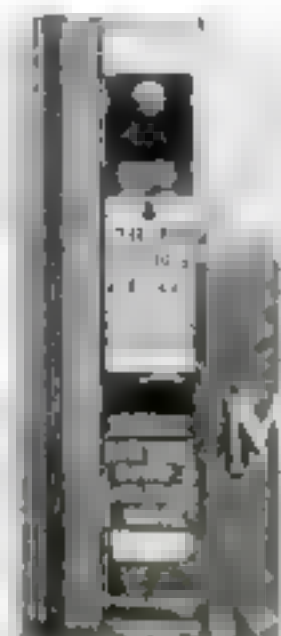


Catching a water snake at night for marking.



Left, top picture shows marks made on a garter snake, after five months. Bottom, tail of a snake with three markings, one recent and two old.

## NIGHT DEPOSITORY FOR TAILOR SHOP



Garment chute on floor of cleaning shop with instructions for using.

appears in a slot below the main opening of the chute. Then, by means of a wheel, the customer winds the paper on a concealed roll so that the next customer finds a blank space awaiting him. Since the sequence of names on the roll of paper corresponds to the position of the clothing, it is easy to identify the garments.

TO PERMIT customers, after a shop has closed for the day, to leave clothing for cleaning, pressing or repairing an inventor in East Orange, N. J., has developed an ingenious receiving chute. The receptacle is fitted to a narrow opening in a door or outside wall, and clothing dropped in, it falls into a hamper inside the shop. The customer writes his name and instructions regarding the clothing on paper which

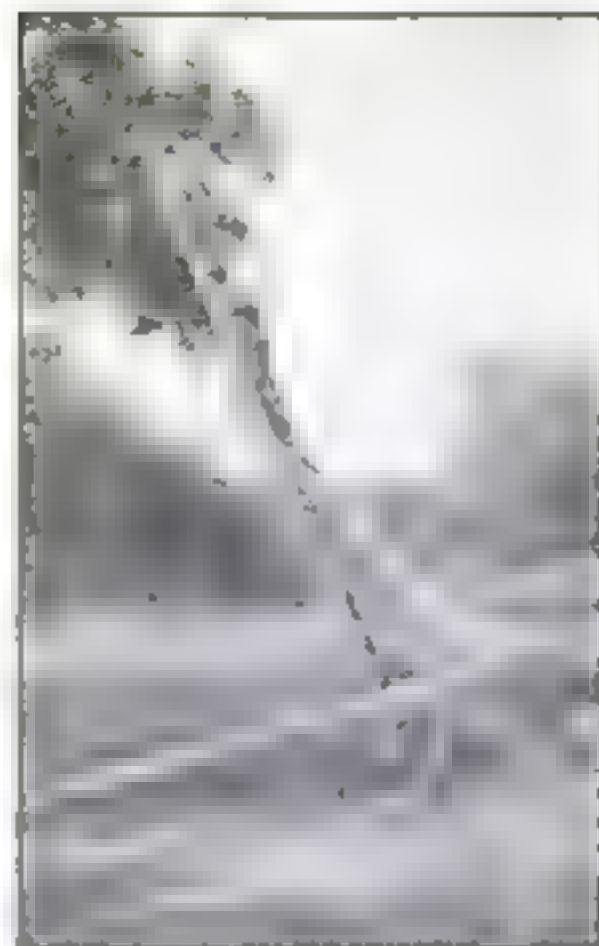


The chute as seen from inside the shop. The hamper in the foreground receives garments.

## DAYLIGHT TOP ON CAR IS UNBREAKABLE



AN AUTOMOBILE roof panel just invented in England will admit light, yet cannot be broken with a hammer. The old type sliding panel, widely used on English cars, admits abundant light and air when open but is difficult to make water-tight when closed in rainy weather. The new panel overcomes this objection. It consists of a steel mesh covered with a substance that resembles glass.



## GRAVITY LOWERS LIFEBOATS ON SUPER-LINER

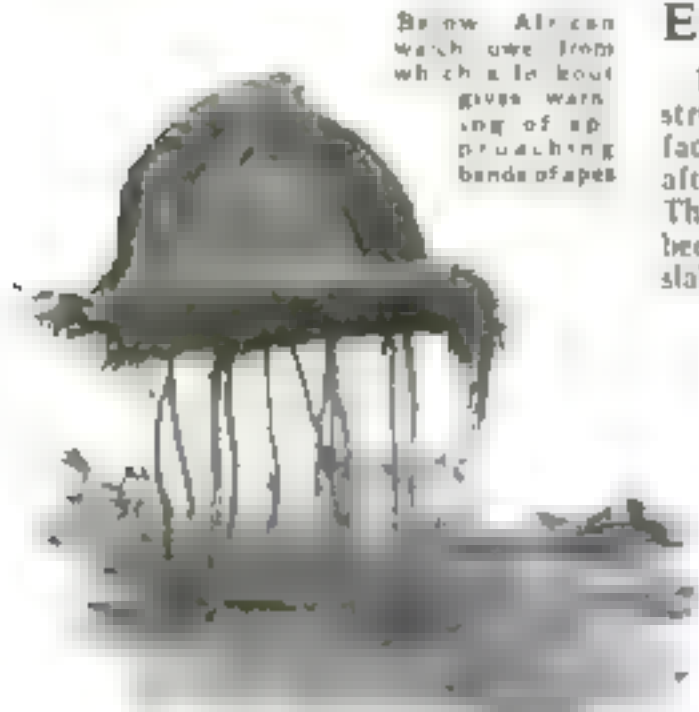
GIANT lifeboat davits, now being installed on Great Britain's super-liner, the *Queen Mary*, designed for unusual safety, operate solely by the force of gravity and can be controlled by a simple lever. When the lever is touched the counter-weighted arms of the davits drop forward after the fashion of a bascule bridge, swinging the lifeboat clear of the ship's side. Heavy cables then unreeel to lower the boat into the water.



Model shows how lifeboats for biggest ship are lowered by gravity

## PUTS LADDER ON WHEELS TO SPEED ORCHARD WORK

TO SAVE himself the labor of carrying a heavy step ladder, a resourceful orchard worker built the ladder on wheels illustrated above. Easily trundled about by two projecting wooden handles, it saves time and trouble in cleaning trees and removing dead wood. Padding on the ladder protects the trees from damage. The wheels were obtained from an old buggy, but the inventor says a pair from an old auto or from a worn out and discarded cultivator would do as well.



By now, Air can watch over troops which a lookout gives warning of approaching bands of apes

## ENTIRE FACTORY BUILT IN THREE DAYS

Using his own method of slab construction, a builder recently completed a factory at Kentworth, N. J., three days after work was started on the foundation. The concrete walls of the building had been cast previously in four foot vertical slabs. After the foundation was laid and

the roof erected, these slabs were lifted by a derrick mounted on a motor truck and set in place. Steel window sash had been cast directly into the slabs, leaving the glazing of the sash the only operation remaining to complete the building. The factory is forty-eight feet long.

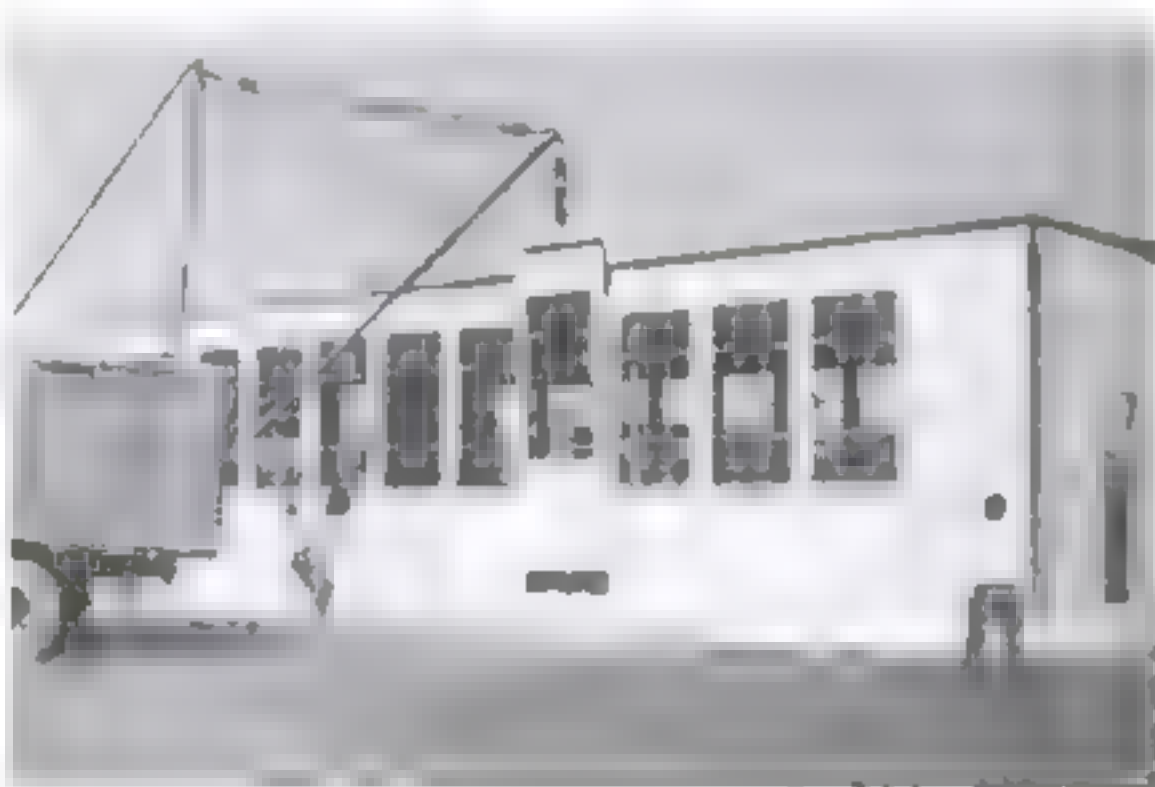


Photo shows four-foot concrete slab being hoisted into place in a building erected in three days

## TOWER WATCHMEN SOUND WARNING AGAINST APES

TO KEEP their cultivated fields from being invaded by apes, natives of British East Africa erect curious lookout towers. The apes, traveling in quest of food, are attracted by the growing crops and, unless driven off, destroy them. Natives post a lookout in the tower, and at the first appearance of the beasts, the lookout sounds an alarm and the apes are driven away.

# Why We Drive on the Right of the Road

HOW many American drivers, to whom keeping to the right is second nature, know the reason for the custom? Behind this familiar rule of the road lies an interesting and little-known story. Early townsmen of British origin rode on the left of a highway as their forebears had. The British custom, which is still observed in England, was originally a protection against banditry. Travelers kept to the left so that the right, or sword, hand would be free to deal with highwaymen. With the development of wagons and coaches, practices diverged. British drivers continued keeping to the left so that the coachman, sitting at the right of his seat to obtain free play for his whip, could see that the wheels of his coach did not collide with those of passing vehicles. Other European countries, however, adopted the postillion system of driving in which the driver or



The Conestoga wagon, historic vehicle of frontier days, is responsible for present American driving customs.

postillion rode one of the wheel horses naturally choosing the left one so that he might wield his whip to best advantage. To obtain a clear view of other vehicles from this position, it was necessary to keep to the right. The same system was adopted by drivers when the distinctive American vehicle, known as the Conestoga wagon, came into use in the United

States early in the last century. Built like a boat so that it could be floated across frontier streams, it offered no interior accommodations for a driver. Consequently he rode the left wheel horse, or the "lazy seat," on the left side of the wagon, and drove on the right side of the road. Other vehicles had to follow the deep ruts cut in the road by these heavy pioneer wagons.

## ICE SPRAY COOLS REFRIGERATOR CARS



Ice is sprayed over the car and its contents to prevent spoilage.

SPRAYING refrigerator cars and their contents with pulverized ice is a recently adopted means of making vegetables and fruit shipped to market by railroad arrive in perfect condition. The ice is shot through a long, flexible hose by a high-power blower. This preliminary chilling applied before the doors of the car are closed, prevents spoilage that sometimes occurs before the food can be cooled by cake-ice.

## DOOR MATS MADE OF OLD AUTO TIRES

DISCARDED automobile tires can be converted into attractive door mats, with machines devised by a Kansas inventor. One of the machines cuts the old tire into strips and the other punches holes in them at regular intervals. With a second punch, rubber washers are stamped out of the old tire. The strips are fastened together by means of a series of wires, the washers being used to separate the strips and form a grill pattern. Many designs are possible.



Old auto tires are cut up to form strips and washers, which are then strung together to make attractive and practical door mats.

Easily attached to a shelf or a ledge, this portable socket will solve the problem of lighting jobs in dark corners.



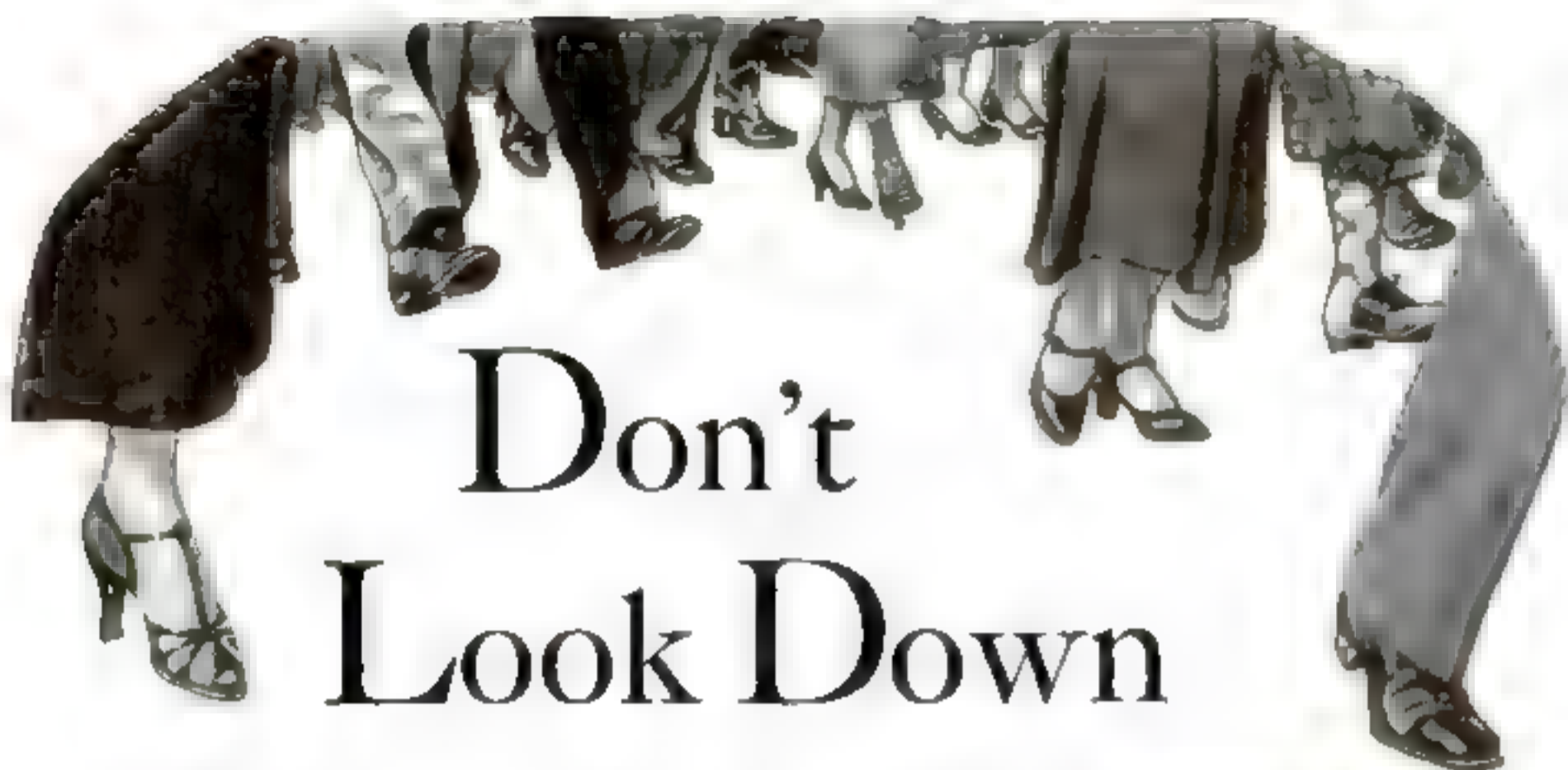
Left reel used as an emergency lamp.

A clip of flexible wire makes it easy to clamp the reel in many odd places.



## REEL HOLDS CORD FOR LAMPS AND APPLIANCES

A NEW electric accessory, comprising a socket and fifteen feet of connection cord on a built-in reel, provides a portable lamp for out-of-the-way places. The cord is plugged into the nearest outlet and the desired length pulled out. A clip on the base of the reel permits it to be attached to a bed, the arm of a chair, or a shelf near a workbench. The device also serves as an extension for appliances with cords too short for the use intended.



# Don't Look Down on Your FEET

**I** CAN'T think when my feet hurt Abraham Lincoln once complained. Neither can you think straight when your feet hurt. Neither could Professor Albert Einstein or any other intellectual giant. As robbers of mental and physical efficiency, and as joy chasers, a pair of protesting feet are in a class by themselves.

So don't neglect your feet. It doesn't pay. Respect them and treat them right, and they'll carry you pleasantly through life. Treat them badly, and they will set up a chorus of aches and pains that will make your days miserable.

Few people realize how much they use their feet. Tests have been made to determine how far we Americans of the motor age walk. People of various ages and occupations were equipped with pedometers, sent about their ordinary daily activities, and their pedometer readings carefully tabulated. The results were astonishing.

One active schoolboy clicked off an average of fifteen miles a day! A schoolgirl averaged eleven and one-half miles. A business man who played a good deal of golf walked nine miles a day. A saleswoman's average was eight miles.

The average distance walked in a day by average people was found to be 18,000 steps—seven and seven-eighths miles. That amounts to 2,870 miles a year—close to the road distance between Washington and Los Angeles or between Boston and Yellowstone Park. If you live a normal length of time, and are normally active throughout your span of years, you'll have to depend on your feet to carry you over a total of some 175,000 miles. You'll walk a distance equal to seven trips around the earth at the equator.

Professor G. Elliot Smith, noted British anthropologist, reports that recent discoveries show that the prehistoric Peking

By **ARTHUR GRAHAME**

Man who lived in the caves of northern China over a half million years ago, had hands like the hands of a modern man, but that his feet were like the feet of an ape. He must have walked with his toes turned in, as an ape walks.

**B**UT since the dawn of history there has been no fundamental change in the human foot. Roman legionaries, who hiked their fifty miles a day on forced marches when the Carthaginians invaded Italy more than twenty centuries ago, marched with the same efficient tractive arrangement of twenty-six small bones held together by a network of ligaments as do the soldiers of today. The feet of the savage peoples of the present offer but little from the feet of civilized men. The big toe of the savage is more widely separated from the other toes, and the toes are of more nearly the same length than are the toes of shoe-wearing people, but they are exactly the same as were the feet of savages 4,000 years ago. The feet of a baby born of civilized parents today are exactly the same as were the feet of a baby born of civilized parents centuries ago. Nature has made no change in the human foot but the feet of civilized men have been changed by many generations of shoe wearing, and the feet of many persons have been cramped and sometimes deformed by their owners' vanity or thoughtlessness in wearing improperly shaped or poorly fitting shoes.

It is quite possible that it was from the human foot that the early engineers got the idea of the arch as an architectural weight carrier. Certainly the two main arches of the foot, taking into consideration their small size and the amount of weight that they must carry and the severe and varying strains that they must withstand, are highly efficient.



Standing on a book, with the toes grasping the edge, and then rising on the balls of the feet, strengthened weak arches.



Another good exercise for weak arches is shown above. Grasp the ball with the toes, when sitting down, and raise it.



Feet can be developed in this manner. The idea is to pick up a small marble.

One of these main arches, the longitudinal, extends from the heel to the ball of the foot. The degree of its arch varies with races and with individuals. The arches of the moccasin-wearing American Indians usually are high. The arches of members of the white race normally are high. The arches of Negroes nearly always are low. This does not mean that they all have weak feet, although an army surgeon who has served in the field with both white and Negro troops tells me that white men's feet are much the stronger, and their marching better. As a general thing, the heavily built members of any race have lower arches than do those of lighter weight and are the ones who suffer most from foot trouble.

**T**HE other important arch of the foot is the anterior, or metatarsal, arch. It is formed by the heads of the bones of the forefoot, and extends from the inside to the outside of the foot at its ball.

These two arches are the real foundation stones of the human body. If, in a building, the foundation gets a fraction of an inch out of alignment, a weakness is likely to develop in an upper wall. In the same way, if the foundation arches of the human body are weakened, flattened, or forced out of their normal position, ill effects are likely to be felt in almost any part of the body.

It is estimated that nine people out of ten suffer from more or less serious foot trouble, and it is a known fact that four out of every five men who failed to pass the army physical examinations during the World War were rejected because of their defective feet.

Feet that hurt are so common that many people have come to regard them as a natural ill of mankind, and do little to get relief. There was, for example, a gentleman of seventy-five years who told his physician that for a long time he had felt severe pain under one of his metatarsal arches. The physician made an examination; then extracted something that looked like a quail. The patient, a Confederate veteran, then remembered that during the Civil War he had kicked

a porcupine that had invaded his tent. The results had been painful to the soldier, and an army surgeon had spent half an hour picking quills out of his foot. But he had missed one and the old gentleman for years had endured the pain that it caused, putting it down casually to "sore feet." The same degree of pain in any other part of his body would have sent him hurrying to a doctor with a demand for quick relief.

Most foot pains aren't caused by accidental injuries. Neither are they caused by congenital foot troubles. They are the result of wearing improperly shaped shoes, or shoes that are either too large or too small.

When man began to wear foot coverings, it was solely for the purpose of protecting his feet from cuts and bruises. Early sandals, which did not in any way constrict the foot, were real orthopedic shoes. So are the sandals worn by Japanese coolies today. And, by the way, some foot specialists think that our hosiery manufacturers would do our feet a big favor if they would make socks and stockings on the Japanese model, with a separate compartment for the big toe.

Civilized people of the more prosperous classes soon became discontented with mere sandals. Spending most of their waking hours on horseback, and looking down on people who walked, they thought little of

foot efficiency. In that respect they were like our cowboys, who still cling to their traditional high-heeled boots under changed working conditions that make them spend much of their time in discomfort afoot. As the years passed, the shoes of upperclass people became things of beauty more than of utility. Heels, which grew ever higher, were placed under the rear portions of footgear made of silk and of richly decorated leather.

(Continued on page 110)

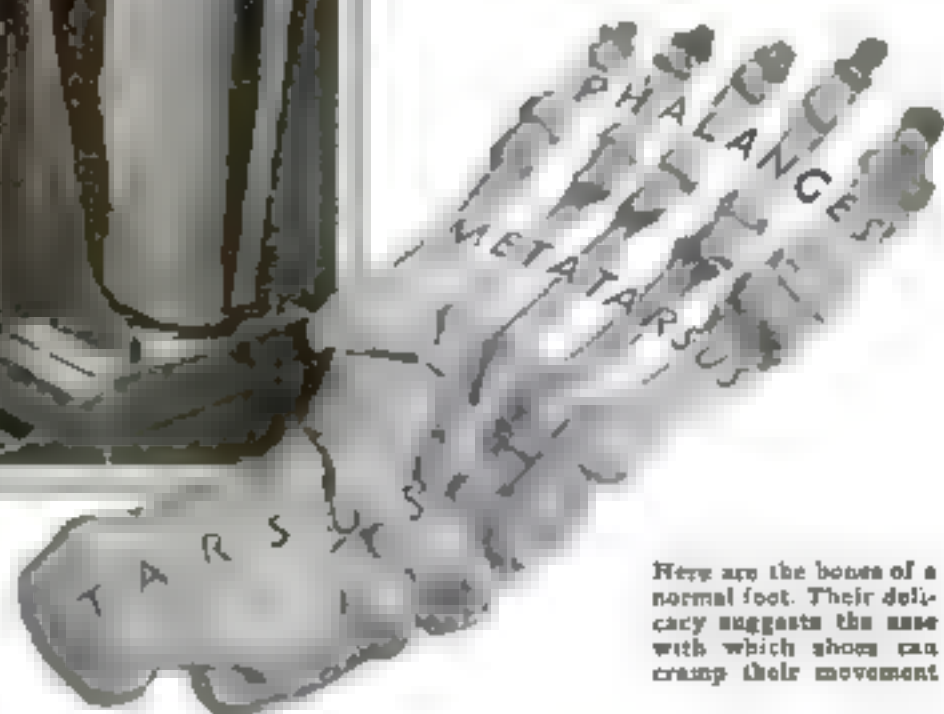


The feet of some natives in palm-growing regions are so prehensile that they can climb trees by grasping them with hands and feet.

Natives in the Belgian Congo wear sandals like those seen below. Note ball between toes that holds sandal.



X-ray shoe-fitting machine. The customer stands as shown and he can then see the bones of his feet through the shoes he is trying on. In this way he can tell if the bones are being forced out of position.



Here are the bones of a normal foot. Their delicacy suggests the ease with which shoes can cramp their movement.

## GAUGE SHOWS WIND'S EFFECT ON CAR



Above: homemade air speed gauge mounted on radiator and ready for use. Right: the dial of the gauge with each scale division representing ten miles an hour



Right: close up of the unusual gauge showing the tiny propeller that turned by the wind moves the needle across dial's face

AN AIR-SPEED indicator, resembling those used by airmen, has been built into a radiator ornament by a California motorist. Registering the relative velocity of his car and the wind, in miles per hour, it affords him an accurate way to observe the effect of streamlining in reducing wind resistance. The operating mechanism, enclosed in a double funnel or venturi tube includes a diminutive propeller that is turned by the driving force of the wind until counterbalanced by the tension of a coil spring. An indicator fixed to the same shaft as the propeller, then shows the air speed directly reading in tens from zero to 100 miles an

hour. In still weather, this speed equals the reading of the car's speedometer, while it is higher against a head-wind and lower with a tail-wind. Tests with the home-made instrument have shown that a car's performance varies markedly in traveling with or against the wind



## SIGHTING OUTFIT HELPS FOOTBALL OFFICIALS

USING a newly invented sighting device that looks like a surveying instrument, a football linesman can measure yardage with absolute accuracy. Invented by a California coach, the instrument consists of two poles connected by a ten-yard chain. One pole carries a sighting tube with lenses in each side as well as in one end. A flag marker is set up at each end of the sideline and the tube is so adjusted both flags are reflected in the lenses

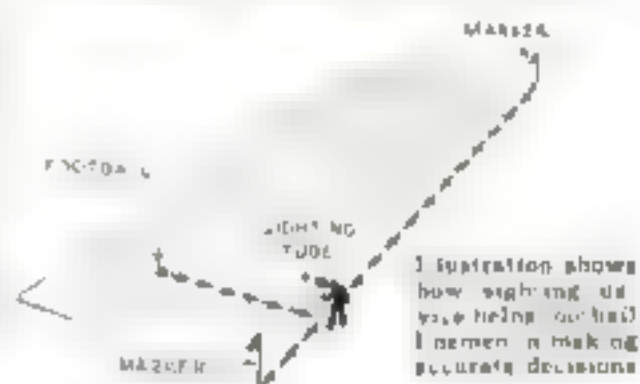


Illustration shows how sighting device helps football linesmen in making accurate decisions

## NEW ELASTIC THREAD CONTAINS NO RUBBER

A THREAD that stretches, yet contains no rubber, is the discovery of a French inventor. The secret of the elastic thread lies in the method of weaving it, which is said to be applicable to cotton, silk, or wool with equal success. Tests by stretching the thread and soaking it under water for forty-eight hours are reported to have revealed no flaws. Its application is foreseen for clothing of all sorts, including dresses, bathing suits, hats, shoes, and all sports apparel.

## INSECT TRAPS RAISED BY KITES

Huge kite-borne nets are being used in England to capture from the upper air specimens of insects invading the country. The kites used in the work have sail like fins to give the greatest possible lifting power. Carried aloft by these kites, the conical nets stream through the air like giant wild-socks, scooping up the insects in their path. The nets, when they leave the ground are closed by a draw-cord laced through them a short distance from the throat. An automatic control opens them when they reach the desired height. The traps close as the kites are drawn down.



Traps, attached to kites, are carried aloft to capture insect pests



## LIFE PRESERVER FORMS A STORMPROOF CABIN

ALMOST as comfortable as if he were on dry land is the occupant of a new life preserver made of two rubber sections that can be inflated with air. The interior forms a roomy cabin, while a stormproof window affords a view of the surroundings. A pole and flag at the top constitute a signal to attract the attention of passing vessels so that the person within may be rescued. The photograph above shows the device in the water during a recent test of its efficiency



## Aircraft Can Fly As One or Two Planes



**A** FLYING craft that splits in mid-air into two separate planes, each capable of flying independently, has just been patented by a British inventor. The composite machine comprises one plane mounted and locked in a cradle on the back of another, in such a way that the pair may be flown as a unit and behaves precisely like a conventional craft. Whenever desired, however, the two planes may uncouple themselves and go their separate ways. Thus two transport craft could be hitched together to operate over trunk sections of airways and could separate in the air to serve diver-

Above, duplex plane in the air with the upper plane just leaving the carrier for an independent flight. At top, diagram explains how the planes separate in mid-air.

gent branch routes, eliminating time lost in landing and transferring passengers, mail and cargo. Another possible application is foreseen in military use, where a machine that could multiply itself and beset a bewildered adversary from two sides at once might have a marked advantage. Joining two planes so that they do not interfere with each other during a take-off and in normal flight, but will separate quickly and positively when desired, with-

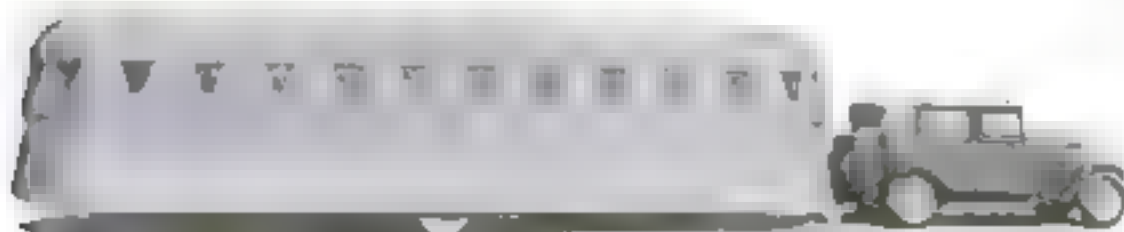
out recourse to mechanical complications such as a tiltable launching platform, presents a tricky problem in aerodynamics. To solve it, the inventor has chosen different wing shapes for the two planes, which give them curious flying characteristics. In the take-off and at ordinary flying speeds, the twin planes tend to cling firmly together, because the lift of the lower plane exceeds its own weight, while that of the upper plane is less than its own weight. To detach the planes, the composite machine speeds up and correspondingly flattens its flying angle, or angle of attack, automatically reversing the previous situation. Operated at this flattened angle, the lower plane no longer is self-supporting and tends to fall, while the upper plane is tugging strongly upward. Consequently, when one of the pilots operates a release that uncouples the upper craft, the two planes leap apart so swiftly that there is no danger of mishap. After dropping away, the lower plane rights itself to regain its own lift, and the two planes fly on independently of each other. The upper of the two planes, as at present designed, is considerably smaller than the lower plane but its range is wide as it is carried to the scene of action.

## NEW TELESCOPE TRAILER OPENS OUT TO FORM REAL HOME

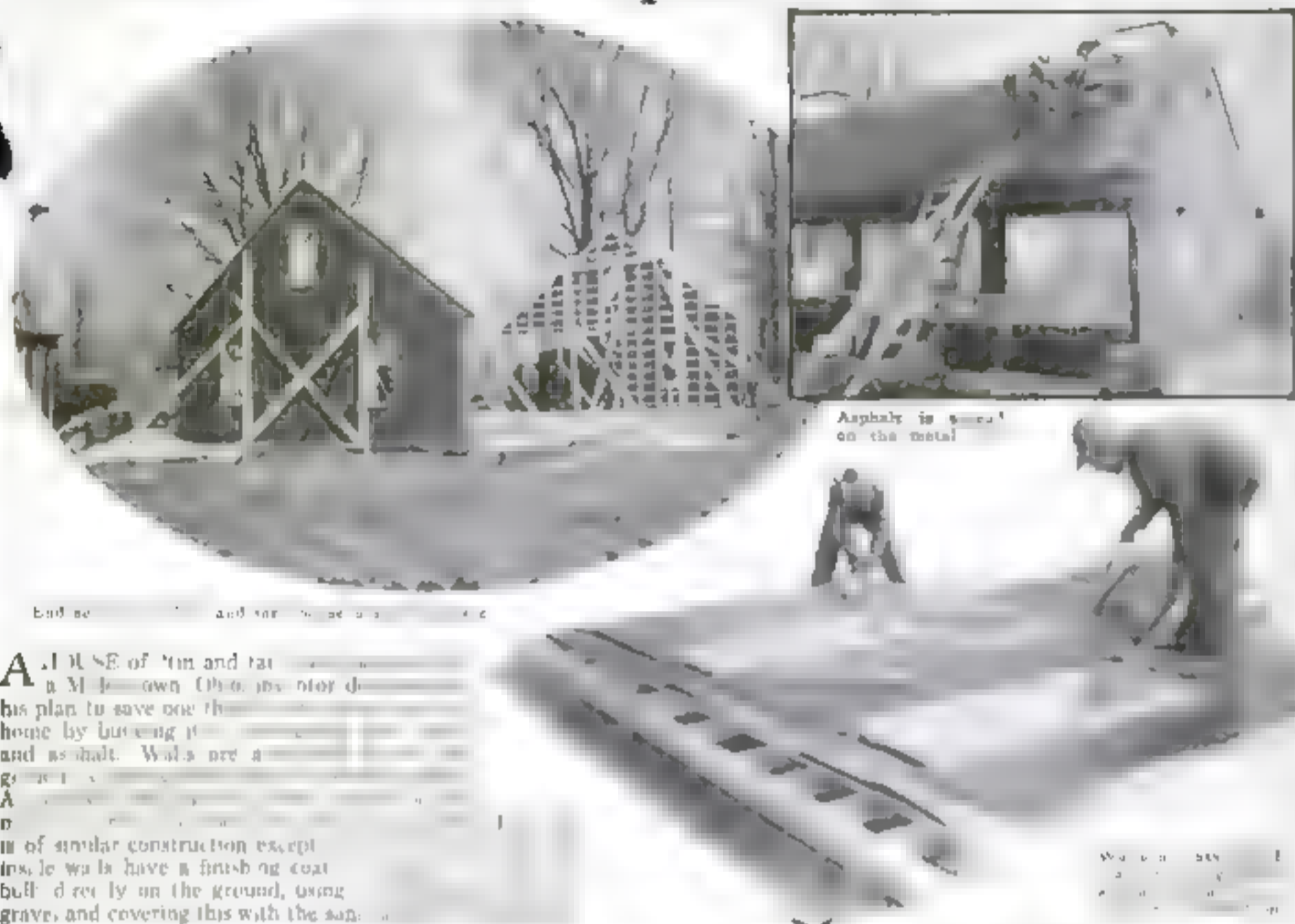
**C**ONTAINING, when extended, as much floor space as a small four-room bungalow, an automobile trailer recently developed by a French inventor can be telescoped for towing into a length of only thirty-seven feet. Extended to its full length of fifty-five feet, the unit contains space for kitchen, dining room, toilet room, and living room. Built-in divans in the living room can be pulled out to serve as beds, thus converting it into a sleeping compartment. Except for the frame, the trailer is built of plywood and is lighted by forty-eight windows. Most of the weight is ahead of the axle, and this end is supported in towing by an idler wheel.



Above, telescope trailer extended to full length. Right, interior of the extended trailer which contains several rooms. Below the trailer as it appears for travel.



# House of Metal and Asphalt Built at Low Cost



Asphalt is spread on the metal

A HOUSE of tin and tar is being built in a Midwestern Ohio town, and the owner has his plan to save one-third the cost of a home by buying it in this way. Walls are a good deal thicker than those of a wooden house. A house of similar construction except inside walls have a finishing coat built directly on the ground, using gravel, and covering this with the same material.

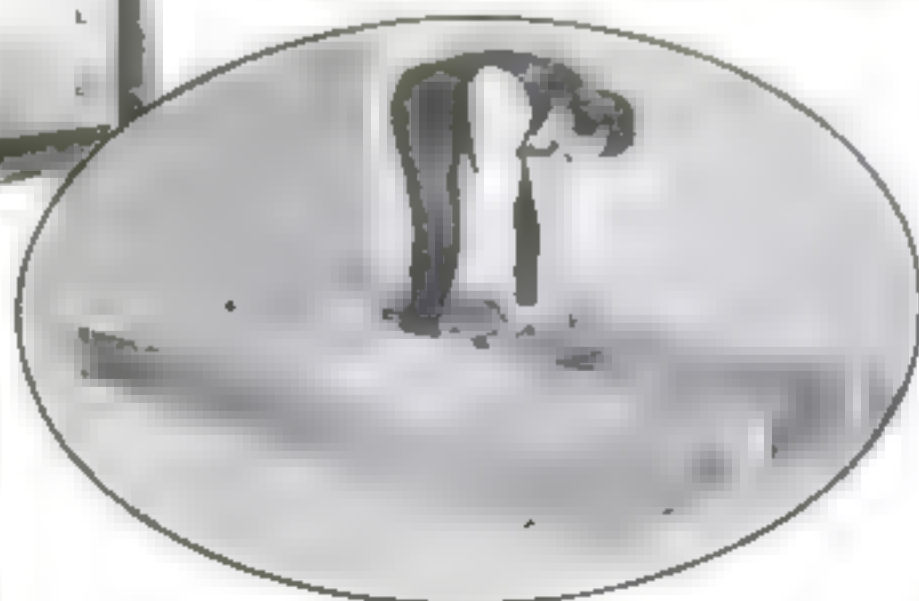
## PRE-CUT JOINTS AID CABINETMAKING



SHELVING and cabinets can be built at home with no tool except a hammer, by using a new kind of pre-cut lumber. The vertical side pieces and shelves are supplied in standard widths and lengths, and are assembled by slipping dovetail tongues on the ends of the shelves into snugly fitting grooves in the vertical sides. Trim and back lining are attached to the finished shelves by tacking with short finishing nails. Drawers, doors and pigeon-hole compartments can be obtained ready-made for use with cabinets. New sections can be added to cabinets or shelves as the need arises.



Above, cabinet built of new pre-cut lumber with dovetail joints cut at the factory. Drawers and doors can be bought ready-made. Right, assembling a set of shelves with this handy material.



## ANTI-AIRCRAFT ROCKET CARRIES MACHINE GUNS

ROCKETS as war weapons have been proposed before, but it remained for a Japanese inventor to produce the strange adaptation of the idea pictured above. The self-propelled projectile is reported to be intended for anti-aircraft use, and designed to fire a hail of bullets during its flight, from machine guns mounted around the circumference of the rounded nose. Test flights of the rocket are said to have been scheduled for an early date.



Seat and back of beach chair, below, is attached to roller that winds it up or down

### SEAT OF BEACH CHAIR WINDS UP ON ROLLER

THE fabric seat of a beach chair recently invented by an English movie actress can be protected from rain simply by rolling it up as one would a window blind. With the ordinary chair of this type, a sudden shower means a hurried struggle to collapse the chair and to fold the fabric seat into some sort of order. The seat of the new chair is wound on a spring roller attached to the top of the back. In setting up the chair, the fabric is pulled out and the rod sewn into the lower end, is slipped into grooves in the forward projection of the frame. When the rod is removed from the grooves, the fabric winds itself upon the roller.

### GIANT AIR MAPS MADE OF 4,500 PHOTOGRAPHS

ONE of the largest airmaps ever made in America is to aid the Department of Interior in regulating the grazing on Navajo and Zuni Indian lands in New Mexico, Arizona, and Utah. Forty by twenty-four feet, the huge map will be formed by fitting together more than 4,500 visual aerial photographs.

## GLIDER STUDENTS TAUGHT BY RADIO



With the portable transmitting station shown, instruction is given to students flying gliders

TIME required to teach students gliding has been reduced at two schools in Germany by the use of radio. Unlike student aviators, the glider tyro is not accompanied by an instructor on his training flights. After preliminary study on the ground, he takes off alone. At the two German

schools, the training gliders are equipped either with radio headphones or loud-speakers. The instructor, from the ground, keeps in constant touch with the pupil, warning him when he makes mistakes in steering. The transmitter used is a modest four-tube set, weighing seven pounds.

## MOVIE CAMERA SPEEDS FACTORY WORK

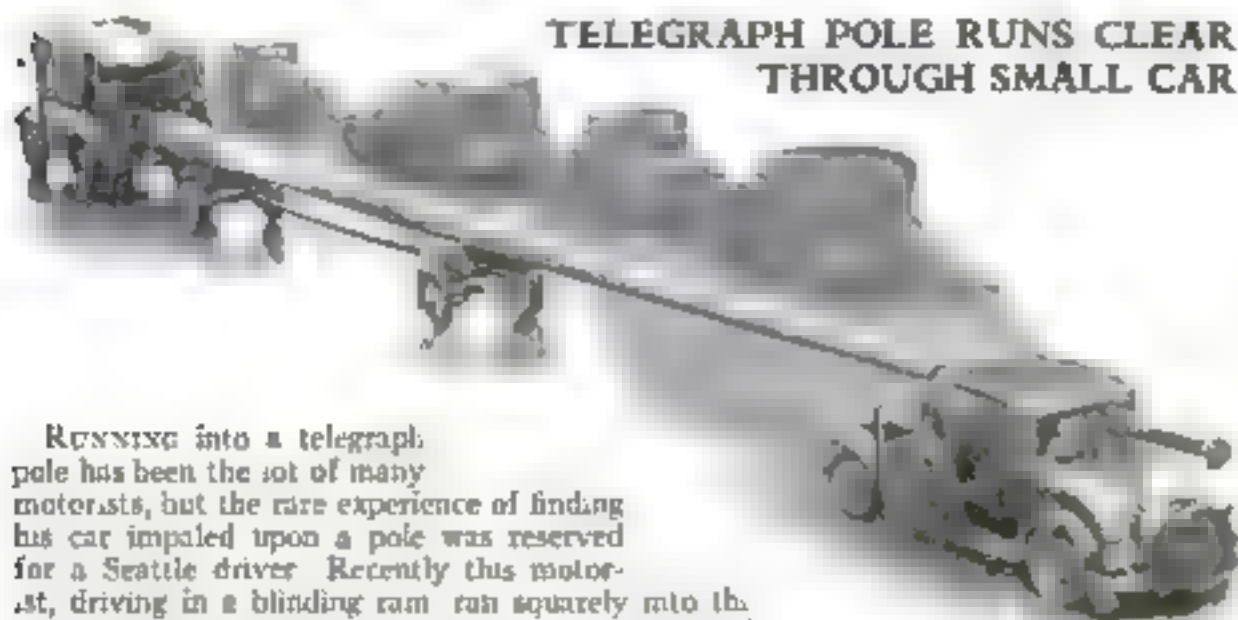
AN IMPROVED method of showing moving objects, such as a workman at his job, employs a movie camera with a constant-speed motor. The number of frames exposed showing directly the time required for each task. Engineers are now exposing the films of this camera to determine the time required to finish a job. The film is then cut into strips and shown in a closed circuit, and over again, making a continuous operation making a complete film desired for exhibition.

Right, finished film made with a new movie camera that shows time required to complete each part of workman's job



A new device with a constant speed motor is used to show time required to complete each part of workman's job

### TELEGRAPH POLE RUNS CLEAR THROUGH SMALL CAR



RUNNING into a telegraph pole has been the lot of many motorists, but the rare experience of finding his car impaled upon a pole was reserved for a Seattle driver. Recently this motorist, driving in a blinding rain, ran squarely into the end of an eighty-five-foot pole that was being hauled along the street. The pole plowed through the car, and emerged through the rear window.

### FORKLIKE TOOL PULLS TACKS



DRAFTSMEN, housewives, and others who use thumb tacks are spared the annoyance of broken finger nails by a diminutive tool that pulls the tacks regardless of the toughness of the material into which they have been stuck. The tool resembles an ice-cream fork, its two tines being separated by a wedge-shaped groove. The tines are thin and can be forced under a tack head which is almost flush with the material holding it. The tack is dislodged by a quick pull.

# Newest Inventions FOR THE HOUSEHOLD



**PHONE-BOOK LIGHT.** A woman can now read her phone book by the light of a small lamp which is held open by a device that also holds the book. The device is made of metal and a pencil rack is also provided at rack's end.



**PHONE-BOOK LIGHT.** A woman can now read her phone book by the light of a small lamp which is held open by a device that also holds the book. The device is made of metal and a pencil rack is also provided at rack's end.

**PLAITS IRONED IN.** Garments are pressed and plated at the same time with this iron recently exhibited in London, England. It comes supplied with attachments for various kinds of plaits and, of course, it can also be used as an ordinary iron. Heated by electricity, its cord plugs into any convenient outlet.

**NEW ANT TRAP.** The ant trap shown above is designed to eat space ants. According to the manufacturer, it will trap and kill twelve pounds of ants and can be used safely in the home.

**HANDLE ON SHOE TREE.** The interlocking wire on this shoe tree below, controls the spring tension, says the manufacturer. The shoe is said to prevent curling and remove wrinkles.



**VARNISH SPREADER.** The long-handled device shown at the right is used to spread varnish on linoleum floors. The length of handle makes stooping unnecessary and it is said the varnish is spread quickly and easily. A removable pad, made of fibers, does brushing. Special varnish for use with the brush is provided. Waterproof, it gives durable finish.

**AUTOMATIC JIGGER.** Liquor is measured accurately and without spilling a drop, it is said, by means of the little device shown above. The jigger is attached to bottle and is filled by tipping the bottle until the rim of the small cup is horizontal. When the cup is full, the flow is at once automatically cut off.





#### NEW SWEEPING BRUSH

When the sweeper, shown below, is in use, the brush, operated by a lever, automatically directs the dust and sweepings into the tray. Thus the housewife saves time.



**STAND FOR NEWSPAPER.** This stand will hold a folded newspaper so that it can be read while the reader is eating. The holder, serving also as book rack, is of brass wire.

**SLIDING REFRIGERATOR DRAWER.** The space-saving drawer shown above is easily installed in any refrigerator and has room for three dishes. It slides in and out thus bringing its contents within easy reach. Its drawers are made of heat-resisting material and they may be placed in oven for heating before removal to the table.



**VACUUM HOLDS THE EGG.** Boiled eggs are held securely in this egg cup. A vacuum cup, working both ways, holds it tighter to the plate and grips the egg.



**SPACE FOR RAZOR BLADES.** Made of metal, the attachment shown below and at left is placed over bathroom shelf and out on any holder the razor but also provides, in its drawer, a convenient place for the blades. The clamp that holds it in place is of spring steel.



**PUTS ICE CREAM IN BANANA.** With a plunger and spring, the tool shown above can be used to force ice cream into a banana. The heart of the fruit is removed with the plunger and cream then forced in.

**COAL STICKS FOR FURNACE.** Coal, compressed in round, paper-covered sticks, is now on the market. With the appearance of this fuel comes a stoker attachment which can be used with any furnace and which automatically feeds sticks to the fire. The stoker's hopper holds enough coal sticks to last for more than thirty-six hours. They are fed in by a small motor.



# Touring the Winter Sky

## WITH AN OPERA GLASS



Above, a star map, made in the form of a lamp shade, is illuminated from within by means of a flash light. In this way the stars you wish to study are easily found.

not satisfactorily fill the need of a time-table. When you go out under the dark sky, away from street lamps, you want some map of the sky features that is easy to hold and consult. You do not want to turn pages or hold a chart over your head for flash-light illumination.

To fill this need the writer has devised a sky time-table in the form of a lantern lighted from within by a flash light. It shows four different translucent maps indicating the star groups in view from horizon to zenith at a definite hour on any night from December 7 to February 20.

Each of these maps shows the sky as it appears when facing a cardinal point at 11 P.M. on December 7, 10 P.M. on December 21; 9 P.M. on January 5, 8 P.M. on January 20, 7 P.M. on February 4, and 6 P.M. on February 20. The lantern accordingly furnishes a convenient guide for stargazing all through the winter season, and as such will be well worth constructing. The photographic illustration shows how the sky time-table is used and the plans indicate the details of construction.

To build the lantern, first take a sheet of thin but strong tracing paper or cloth, such as architects use for plans. Fasten it firmly over the curving map shown. Adhesive tape is convenient or use two or three dabs of rubber cement. Then carefully trace the map lettering. This done, mount the tracing with rubber cement upon a piece of stiffer but translucent paper. Cut this out and join the ends to make a conical lamp shade. Cut out and add the round top, gluing its tabs to the inside of the cone. This completes the essential part of the lantern, but it must be mounted on a support into which the flash light can be inserted from below.

To construct this, secure or make a cardboard tube just large enough in diameter to slide over the flash light you intend using. Join this to a cardboard ring whose outer diameter just fits inside the bottom of the conical lamp shade.

Now for the itinerary of various winter sky sights. You will notice that the surface of the lantern is covered, between the time-table charts, with several small, circular star maps. Each of these maps shows in detail one of the principal opera-glass features to be seen in the winter sky. The number on each detail map corresponds to a numbered location in some constellation visible in one or more of the time-table charts.

**E**VEN the most casual spectator of the pageant of the stars cannot fail to notice that the winter star groups offer a far more glorious spectacle than those that sweep across the sky in summer. Chief of them all is Orion. As he lifts his giant frame above the eastern horizon on these December evenings, he brings with him a bunch of constellations unmatched in beauty and interest by any in either the Northern or Southern Hemispheres.

Few among those who look at the stars with pleasure realize what a fascinating journey of discovery those star lands offer to the possessor of even the weakest of opera glasses. To provide an itinerary, for the opera- and field-glass tour of the heavens is the purpose of this article. An itinerary, however, calls for a map and a time-table. You must, in other words, know where to look, when to look, and what to look for.

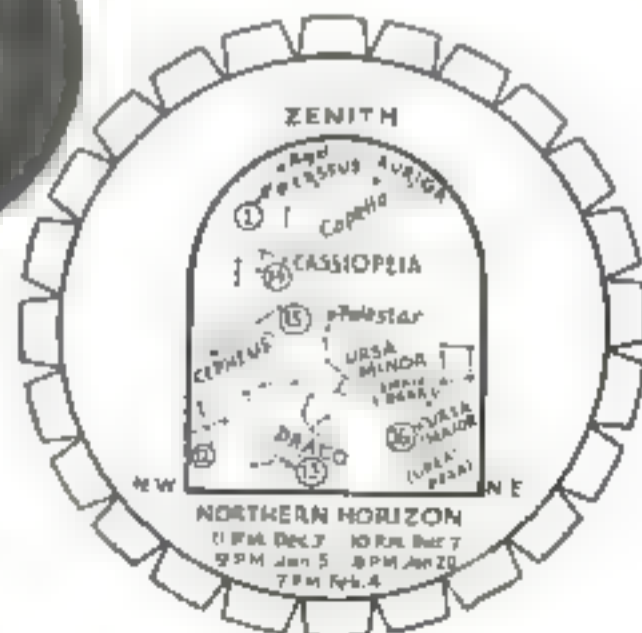
A mere star book, or planisphere, does

### THREE FAMOUS STAR GROUPS

In circle upper left is seen the Beehive as it appears on your lamp-shade star map. This cluster of stars is in constellation Cancer.

In center above is the great nebula in Orion. Even an opera glass will show you that what to the naked eye looks like a star is the nebula.

In third circle above, and at right, the star Algol, in the star group Perseus, is shown. Its brightness undergoes constant change.



## Brilliant constellations visible in northern heavens can easily be identified with the homemade device described in this article

For instance, Circle No. 2 shows the appearance of the Pleiades through an opera glass. To see where to look in the sky for the Pleiades, find No. 2 on the map. The constellation Taurus containing the Pleiades, is in view in the East in December and in the southern sky during January and February. In the same way, each of the seventeen numbered opera- or field-glass features shown in the small, circular maps can be found by the figures on one or more of the time-table charts.

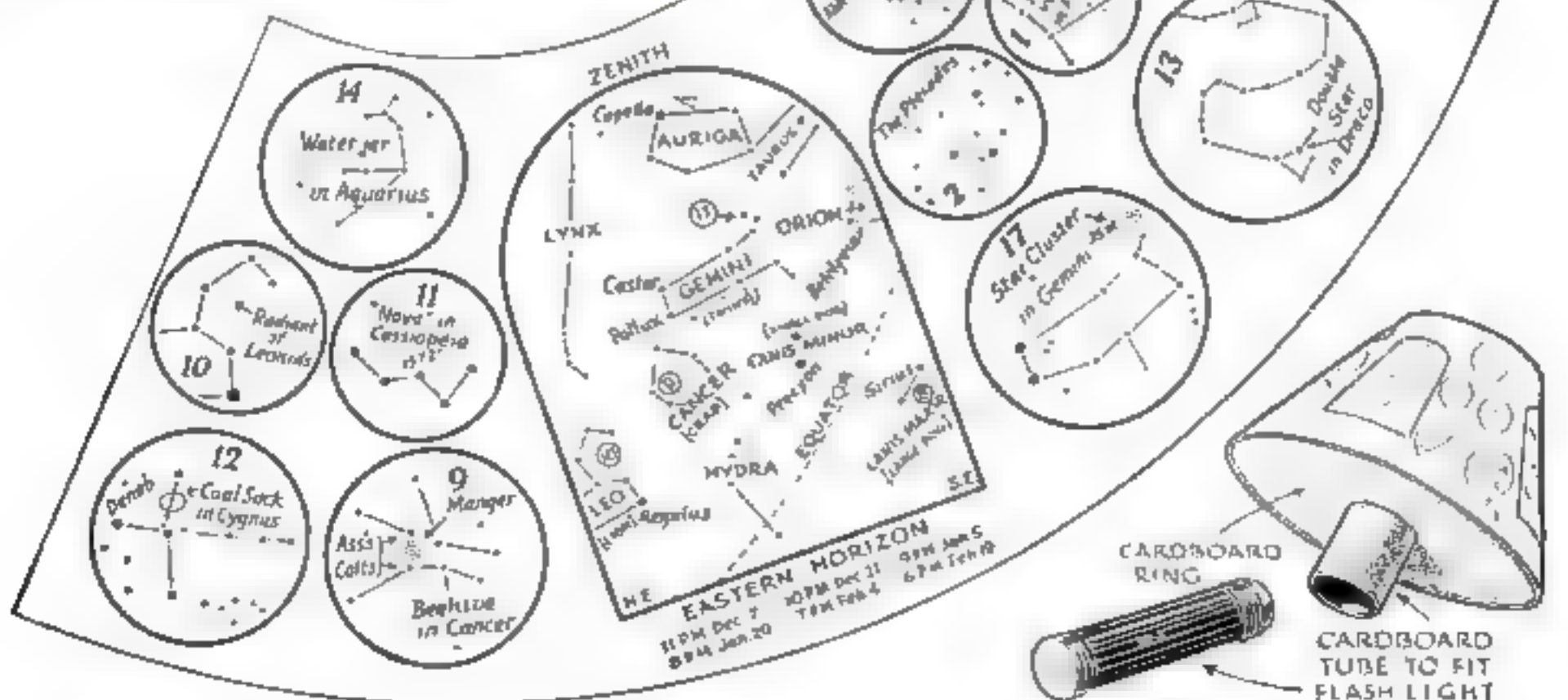
When using the lantern thrust your lighted flash light up through the handle tube and view the maps by the soft glow from within. Then, after finding the feature to be studied, study it in its small circular detail map until you are familiar with what you need to look for. Switch off the light and identify the features through the glass, consulting the detail map again when necessary.

While studying the detail maps, it is advisable to be sitting down comfortably, meanwhile holding the lantern by its handle tube and turning the flash light on and off with your left hand. The opera or field glass, held in your right hand, can then be steadied upon the top of a photographic tripod. You will find the tripod a big help, particularly in using a field glass of six powers or more. The greater the magnification, the harder it is to hold the glass steady in observing fine details.

When the time-table for your three-months tour of the winter sky is complete you can set off without delay. You receive this magazine in early December. The time-table can be used from December 7 to February 20. The following numbered paragraphs describe the numbered detail maps and in each case the time when the feature can best be observed is noted in the description.

1. **ALGOL**, famous variable star: You will find Algol in the constellation Perseus high up in the eastern sky in December; and near the zenith of (Continued on page 8v)

By **GAYLORD JOHNSON**



### MAKING STAR LANTERN

Trace the map shown here and then mount tracing upon a piece of heavier, but translucent paper. The ends are then joined together and the map is mounted on a support so that you can slip a flash light inside to illumine map. Top of shade appears at bottom of opposite page. Trace it also.

# NEW TESTS Reveal Ancient Forgeries

**A**NCIENT forgers of "rare" manuscripts, clever and ingenious as they were, are no match for scientific tests now used in the Huntington Library, San Marino, Calif., to detect literary fraud. No matter how convincingly the faker imitated the writing of a famous author, his work is quickly exposed by powerful microscopes, ultra-violet lights, and other scientific aids employed by the modern manuscript detective.

The forger always exercised great care in selecting an ink he believed to be the same color as that used by the original author. He did not know that microscopes available today would disclose the slightest differences in color. The modern investigator works in a little black, hooded cabinet, covered in front by a paper filter curtain. Under a microscope in this filtered "north" light differences in color between original and spurious writing become strikingly apparent.

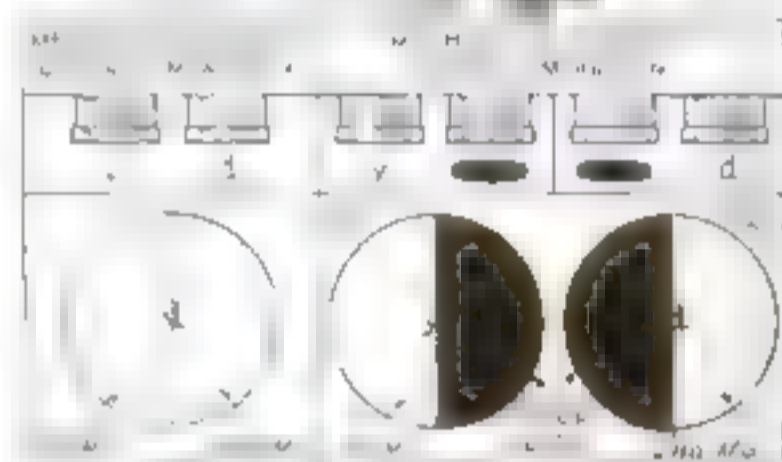
but fraud itself is of great age by using an old patch whose original writing had faded. The old patch is placed under a lamp and the light is directed at the writing.

today look through a microscope and read the more ancient.

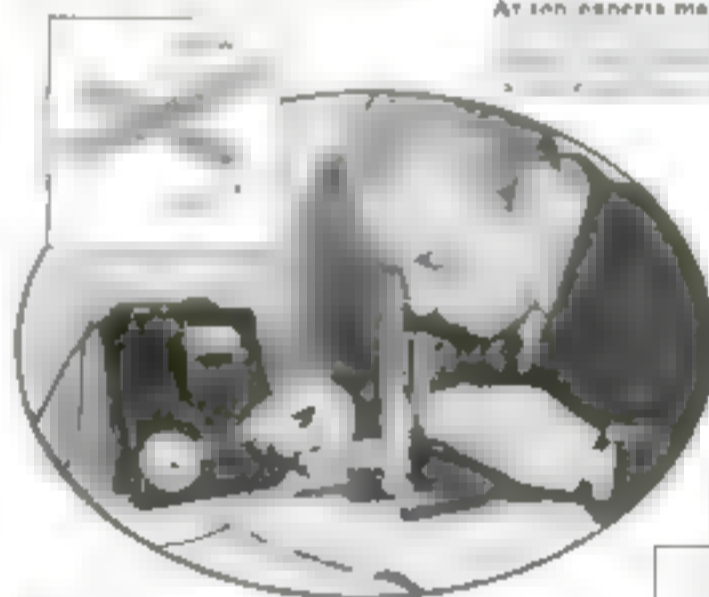
Pencil forgeries are easily detected. A similar apparatus of light is used for this purpose. It is built in the barrel of the microscope. An investigator using adjustable color

the light obliquely downward upon the suspected writing. By means of a rheostat, he regulates the intensity of light until the pencil marks cast just the shadow he desires. When the lighting is right, the minute streaks of both the original and fraudulent pencil marks are seen clearly by their shadows.

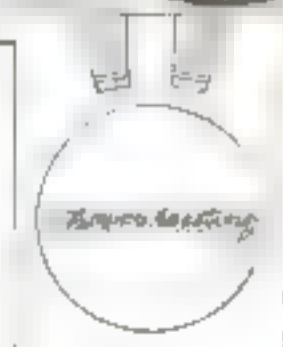
In another test a curious reading glass is used. This is fitted with a glass disk beneath the magnifying lens. The disk bears an incredibly fine pattern of hair-line blocks and circles, and with this pattern the investigator can measure precisely the size of written characters and the word spacing.



At top, experts match up ink colors of two documents. To do



A similar microscope is used to check a writing that has been copied. The use of two lenses gives a clear view of the writing. The shadow shows the original work.



# Collecting Butterflies

## THRILLING HOME HOBBY



Above, two examples of the beautiful creatures that are captured by moth and butterfly enthusiasts and mounted for exhibition purposes or for exchange.



Above, a captured butterfly is seized with tweezers and placed in a cyanide box where the fumes kill it. Right, preparing a dead butterfly by placing it on its back and carefully stretching out the wings.

By  
**ALBERT  
CARTER**

**H**IGH among the ash and laurel of the Rocky Mountains an enthusiastic young collector seeks out the giant Two-tailed Swallowtail, whose five-inch wing spread gives him the heavyweight title among North American butterflies. Down on the Texas plains another naturalist nets a tiny Pigmy Blue whose wings stretch no more than three eighths of an inch from tip to tip.

Deep in a Guatemalan forest a third collector captures an exotic Owl butterfly, whose underwings contain owl-like eyes. On a lifeless tree in India another gathers into his green net a Snake's Head moth whose outer wing tips bear striking resemblance to snakes' heads.

From plains, forests, and mountains the world over rare and beautiful butterflies and their night-flying relative, the moth, find their way into American collections. Capturing and raising them has become a large industry. The hobby belongs to amateurs, of whom there are tens of thousands, for it requires only a little skill, a very small investment, and a desire to seek out one of the most beautiful creatures ever evolved by nature.

You may adopt this hobby by simply deciding to do so. Years ago I raised butterflies on a screened porch. Then my collection began to grow. I moved it to a canyon in the hills near Roscoe, Calif., built a log cabin and screened in a large area. During the last eight years I have captured thousands of the little creatures, received some 60,000 from other collectors and have today many thousand specimens in my cases. From my long experience I have learned many secrets which will guide you into easier methods of capturing, growing, and preparing your specimens.

The average devotee of this





After a butterfly has been carefully prepared and dried, it is placed against a white background and covered with glass



Your butterfly or moth should be killed by placing it in a cyanide jar. Don't breathe fumes

sport is more interested in acquiring a personal collection of rare and beautiful specimens than in gathering them for sale. Butterflies, however, do have a definite value and prices range from one half cent up according to scarcity and demand. The pearly white *Morpho zephyrus*, a very rare butterfly of Chanchamayo, Peru, is worth \$15 a pair, while the black and white *Ornithoptera victoria regis*, or bird wing, of New Guinea has brought \$250. The female measures seven inches across the wings and is one of the largest known.

There are over 1,800 varieties on the North American continent, and amateurs sometimes add to these by discovering new types. Of the known forms, the Painted Lady and the Monarch are the most widespread. Most common butterflies may easily be captured. Rare varieties will lead you on exciting jaunts into out-of-the-way places, but butterflies by the hundreds may be raised with such simple equipment as a few yards of cheesecloth and a box with two sides knocked off.

Raising butterflies in captivity is an excellent way to obtain fine specimens. All butterflies and moths pass through four successive life stages—egg, caterpillar, pupa (chrysalis or cocoon), and adult insect. You will have no trouble in propagating them from any of the earlier stages including the egg itself.

To secure a moth cocoon, place a cloth cylinder over a plant on which a moth is feeding, as is illustrated below



Butterflies lay their eggs upon the plant on which the caterpillar feeds. Watch a female that is hovering about a plant or tree, and settling occasionally upon a leaf. When she has flown away you are likely to find an egg securely attached to the top or under side of the leaf or to the twig itself, perhaps alone, or sometimes in a cluster of more than 100. The *Vanessa antiopa*, one of the first butterflies of the year, lays its eggs in early spring around a willow twig near the tip, usually surrounding the twig entirely for an inch or so. Later when the leaves are larger it lays eggs in clusters, as many as 125 at a time, upon a single leaf. Some butterflies lay only one egg upon a leaf and others lay many, but they always lay them on the same side of the leaf and also in the same general position.

Eggs are hardest to find where there are many of the food plants growing closely together. It is often easier to discover eggs and caterpillars in the city.

Below, a Snake's Head moth captured in India. The resemblance to a snake can be seen at the tip of each extended wing



Details of Net

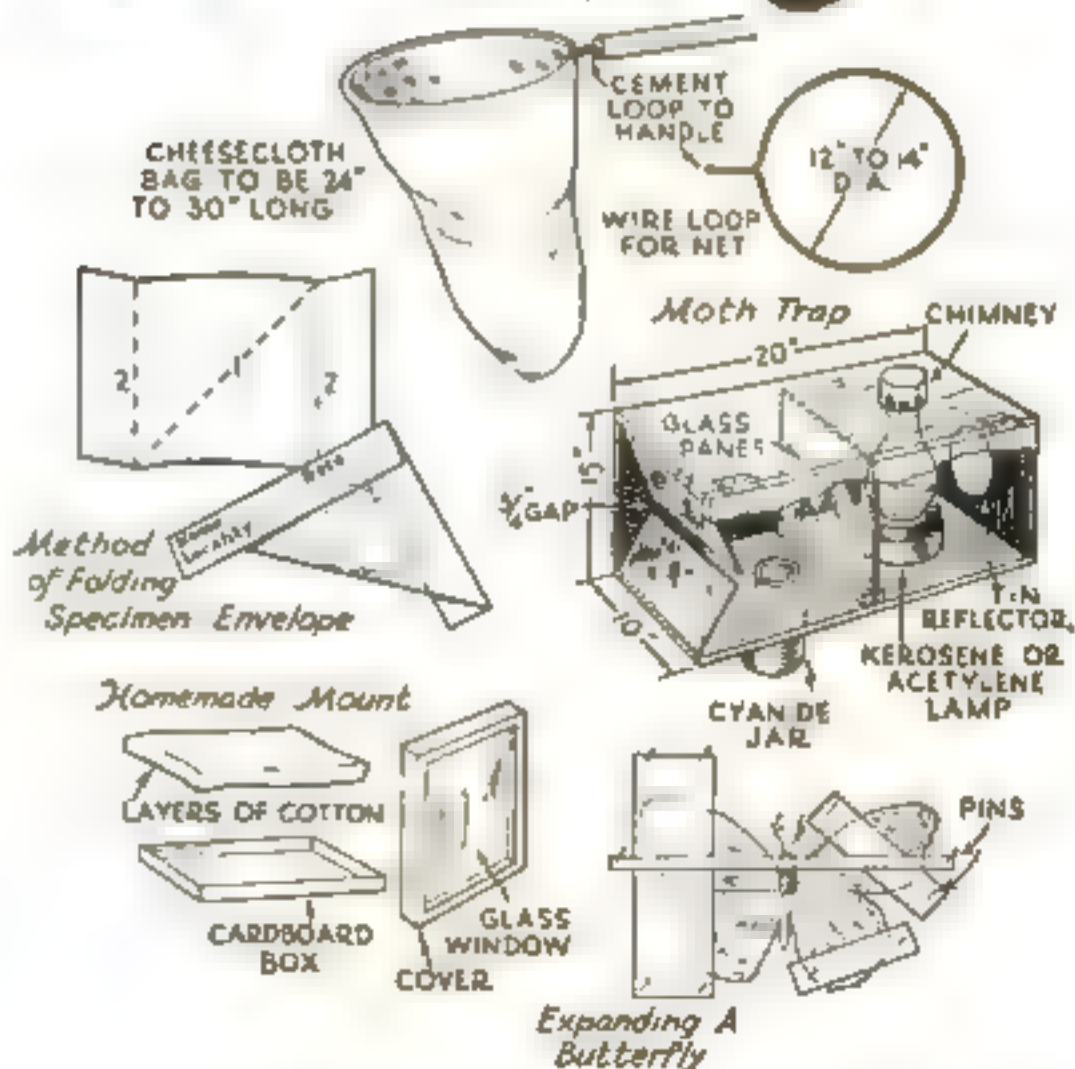


Illustration showing how to build butterfly net, trap for moths, and case in which specimens are mounted. Manner of spreading specimen is also shown

Right, view of author's butterfly farm at Roscoe, Calif. On it are over 50,000 specimens gathered from all parts of the world. Many other specimens are hatched and grown in cage on this farm



Above, Owl moth from India. Turn page up side down and the resemblance to an owl will be clearly seen

Below, Darling underwing moth that is found in United States



caterpillars from the eggs. The leaf bearing the egg can be removed and placed on a similar plant that is enclosed with cheesecloth. You will have better success however, by leaving the branch with the deposited eggs undisturbed, until the caterpillars have hatched out and fed for several days, meanwhile keeping a cheesecloth cylinder tied over the branch. If the plant is large enough to furnish plenty of food, they can safely be left upon it, carefully covered with cheesecloth, until almost full grown. It will be convenient to fold cheesecloth into one long roll several yards at a time, and sew it together to make a tube. It is then cut in lengths of one foot to three feet and slipped over the plants the caterpillars are feeding on, with one end tightly tied around the plant on each side of the caterpillars. Move the tube from time to time as they eat the leaves.

Meanwhile prepare an empty box by knocking out two sides and covering them with cheesecloth. When the caterpillars are nearly full-grown, they may be transferred to this box. Keep a fresh, unwilted supply of the food plant available for them, in generous quantities, by breaking off branches and putting them in a can of water like a bouquet of flowers. Be sure the caterpillars are enclosed in cheesecloth or similar material at all times to protect them from the tiny fly that lays its eggs in the live caterpillar, eventually killing it. If all these precautions are carefully observed, the full-grown caterpillars will soon attach themselves to the top of the box, where they will change into the chrysalis state and come out a few days later as butterflies. When the butterfly is a day old, and before it has a chance to lose any of its beauty, place it in the killing jar, the construction and use of which is explained later in this article.

Of course you can start with the caterpillars themselves, instead of the eggs, and raise them according to the methods just described. It is also possible to raise the caterpillars in a box from the start but the foregoing method has much to recommend it.

Hunting the chrysalids of butterflies, and the cocoons of moths, provides you

where the food plants are fewer, than in the country. Plants in yards and vacant lots or along curbinges, in cities and towns, make good hunting grounds.

You will not have to look afield for eggs, however if you catch the female butterfly with a net and place her in a cage with a food plant appropriate for that species. The cage may be made of two hoops and three laths, joined to make a barrel-shaped framework and covered with cheesecloth, with the bottom left open. Food plants may be planted in one or five-gallon tin cans and placed in this cage, together with a bouquet of fresh flowers. The cage, containing the imprisoned female, is then pressed into the ground to keep it from blowing over, the ends of the laths being sharpened for this purpose. After two or three days, many eggs should have appeared. If the butterfly is one of the many species that will lay them in captivity. Since they have been protected from the start, all eventually should become perfect butterflies.

Now you are ready to raise



In preparing your specimen for exhibition, it can be mounted on a grooved board as is shown above



This moth trap, consisting of cyanide jar, funnel, and light, will capture and kill countless moths while you sleep if it is properly placed under a thick growth of vegetation on which moths feed

with another way of obtaining specimens. Moth cocoons in particular are easy to find during the winter, for the large size of many of them makes them conspicuous among the bare twigs to which they are attached. Chrysalids or cocoons may be placed in a screened box and sprinkled occasionally with a few drops of water until they hatch. To obtain moth eggs put the males and females together in a box covered with cheesecloth or window screen, as soon as they have come out of the cocoons and their wings are dry and ready for flight. Leave them together for a day or so, and then remove the male. Most moths will lay their eggs on the screen or walls of the box, or on twigs of their food plant if it is placed in the box.

The eggs may be removed in a day or two, folded into a leaf on the growing food plant which is pinned together to keep them from falling out, and the whole covered with a cheesecloth cylinder to protect them from ants and other enemies. Watch them occasionally to see that they have a plentiful supply of green leaves, moving them to another branch as often as may be necessary. Some moths pull the edges of the leaf together and then spin their cocoon inside others fasten it securely to a small limb of the tree where it swings all winter and in the colder climates is frozen many times before coming out in springtime.

Capturing full-grown specimens is the most exciting part of butterfly collecting and many fine ones can be obtained in no other way. A net is an absolute necessity in collecting many kinds of butterflies, but you can catch just as many with a homemade net as with one costing several dollars. All you need is some stiff wire a yard or so of net or ordinary cheesecloth, and an old broom handle. First

bend your wire to a circle twelve or fourteen inches in diameter then bore a hole in the end of an old broomstick and insert the twisted ends of the wire. The wire may be fastened in the handle by first filling the hole with a mixture of sawdust and glue then inserting the wire and allowing it to harden before using. It may be fastened by pouring melted lead in the hole around

the twisted ends of the wire or plaster of Paris may be used. The end of the handle should then be closely wrapped with strong twine, painted over with glue, and allowed to harden.

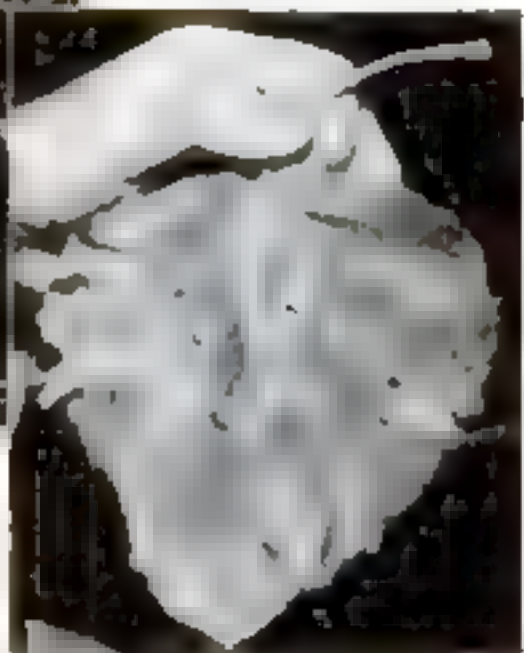
Next, make the bag twenty-four to thirty inches long, and sew the open end onto the wire frame. Some prefer to make the bag smaller towards the bottom as it is a little easier to take out the specimen when it is caught.

To catch a butterfly in flight, sweep it up with the open mouth of the net and then quickly turn over the hoop by twisting the handle, so that the butterfly is trapped in the folded-over end. A butterfly that has alighted near the ground may be caught by clapping the net down over it. Then, while the hoop is resting on the ground, the loose end is lifted with one hand. Most butterflies will fly upward into the end of the net, which may then be grasped and closed below it.

The best and most widely used method of killing butterflies is with the cyanide jar, which is made as follows: Take an ordinary glass fruit jar with a tight-fitting screw top. Put in the bottom of the jar an ounce or two of pure cyanide of potassium or sodium in lumps or crystals. (The cyanides of potassium and sodium are deadly poisons). Mix plaster of Paris with water until it becomes a paste and pour it over the cyanide, covering it completely with the plaster. Let the plaster harden. When it has set solid, cut two or three pieces of blotting paper to fit the jar, and place them down over the plaster to keep the specimen from becoming soiled. Cyanide is a very deadly poison and should be used with care.

A butterfly may be killed by removing the cover of the jar and inserting it in the net or breeding-box, holding it beneath the specimen. Stupefied by the deadly fumes, the butterfly will quickly fall into the jar, which is then closed to allow the lethal vapor to finish its work. After a short time the dead specimen may be removed to be pinned in a collection box if the collector is afraid, or mounted immediately.

Many beautiful and valuable moths can be captured at night while you sleep. Lloyd Martin a *Continued on page 112.*



At top, leaf bearing clusters of eggs laid by female butterfly. Center, a specimen of Dead Leaf butterfly from India. Above, lantern chimney cage used in hatching out caterpillars

When shipping specimens place them in folded envelopes and then pack them in cotton in a cigar box, as shown below

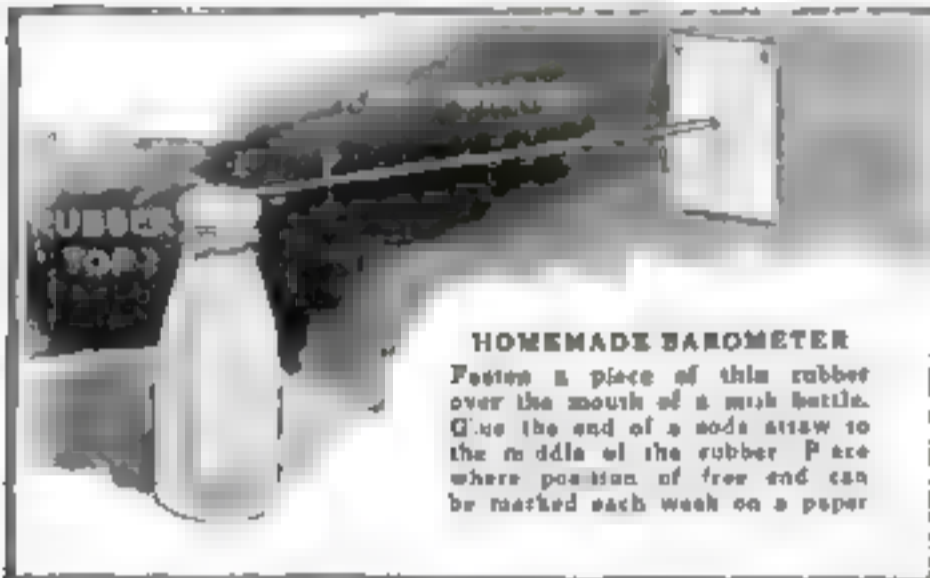


# MAGIC OF SCIENCE IN Easy Home Tricks

*With These Simple, Everyday Things  
You Can Entertain All Your Friends*



**MAKING WATER SHOOT THE CHUTE** Place a piece of camphor on the bottom of an inverted saucer and ignite it. Smoke one side of a long piece of wrapping paper in the fumes and turn up the edges to form a shoot-the-chutes, smoked side up. Drop water on the top and the drops will run down the incline and jump over the gap.



**HOMEMADE BAROMETER**  
Fasten a piece of thin rubber over the mouth of a milk bottle. Glue the end of a soda straw to the middle of the rubber. Place where position of free end can be marked each week on a paper.

## CAMPBOR MAKES BOATS SAIL

Make two paper boats about an inch long and cut a slot and pocket at the stern of each as shown below. Put a piece of camphor in each pocket and float the boats in a pan of cold water. They will sail around for a long time. When they stop, empty the pan and fill it with fresh cold water. Float the boats and they will start sailing again.



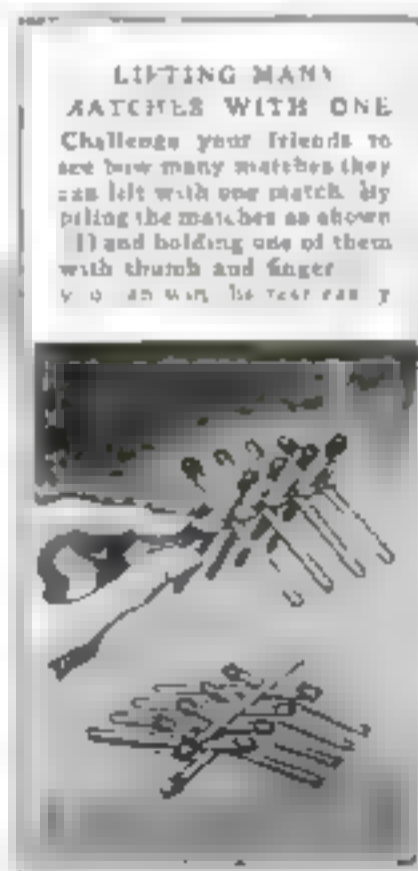
**A COIN AND BOTTLE TRICK**  
Place a coin on a card resting on the mouth of a milk bottle. Flick the card horizontally and it will fly out from under the coin, which will drop into the mouth of the bottle.



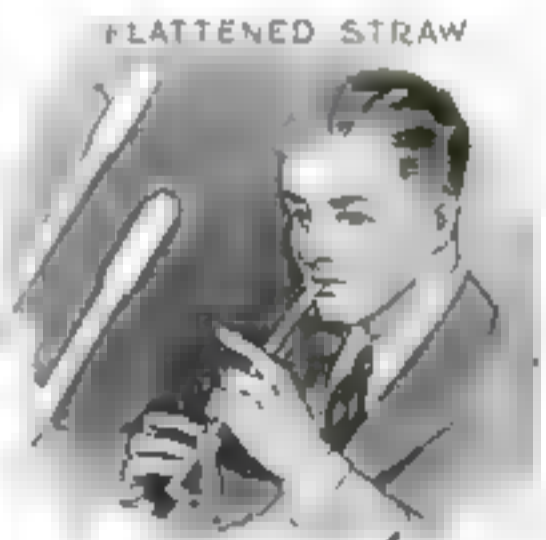
**CRAZY PHONOGRAPH RECORD** Make an off-center hole in an old phonograph record. Put the record on the phonograph turntable and play it using this hole. You can have fun by letting your friends guess what the tune is.



**NOW YOU CAN DRINK AND NOW YOU CAN'T**  
You can mystify your friends with this simple trick. First have them drink water from a bottle through a tube as at the left. Then fill the bottle full of water and close it with a one-hole stopper through which the tube passes. They cannot drink from this bottle, because the drawing of water would produce a vacuum.



**LIFTING MANY MATCHES WITH ONE**  
Challenge your friends to see how many matches they can lift with one match. By piling the matches as shown (1) and holding one of them with thumb and finger you can win the race easily.



**SAXOPHONE FROM SODA STRAW**  
Flatten the end of a soda straw for about an inch and trim off the corners as shown above. Put the end into your mouth and blow. With a little practice you can make a saxophone-like tone. With finger holes at intervals of an inch, you can play tunes.

# Things to Make in

*Products of Industrial Chemistry May Be Reproduced by the Amateur, Supplying Useful Things at Low Cost*

Collapsible tin tubes are handy for packing materials made in the amateur's laboratory

By  
**RAYMOND  
B.  
WAILLES**

acid can be used in its place, or sulphuric acid (two cubic centimeters) can be substituted. The tannic and gallic acids, strange as it may seem, are crystals. For the carbolic acid, the amateur will do best to have his corner drug store make up a solution containing five or ten centimeters of water the entire amount being substituted for the one gram called for in the formula. The blue dye should be water-soluble, china-blue aniline dye. Methylene blue dye cannot be used as it causes a troublesome precipitation when the ink is made.

Although best results will be obtained if a small photographic balance is used to weigh out the chemicals, the experimenter lacking this piece of equipment can approximate the weights by allowing one teaspoonful for each five grams of any chemical. For the liquid measure, an ordinary eight-ounce drinking glass can be considered as holding about 240 cubic centimeters.

In following the formula, first dissolve the tannic and gallic acid crystals in about 400 cubic centimeters of water. In another beaker, containing 200 cubic cen-

**M**ONEY-**SAVING** instructive experiments await the home chemist who turns amateur manufacturer. With his meager supply of beakers and bottles, he can make many valuable everyday substances that will reveal the mysteries of industrial chemistry.

It is perfectly possible, for instance, for the amateur experimenter to make his own writing ink. With very little trouble he can compound a so-called "standard ink"

simply by using the following government formula as a guide. Tannic acid (eleven and seven-tenths grams), gallic acid (three and eight-tenths grams), ferrous sulphate (fifteen grams), hydrochloric acid (three cubic centimeters), carbolic acid (one gram), water-soluble blue dye (three and five-tenths grams), and 1,000 cubic centimeters of water.

The ferrous sulphate in this formula is our old friend iron sulphate, or copperas. If hydrochloric acid is not handy, muriatic

## *Easily Made Electric Heater for Crucibles*

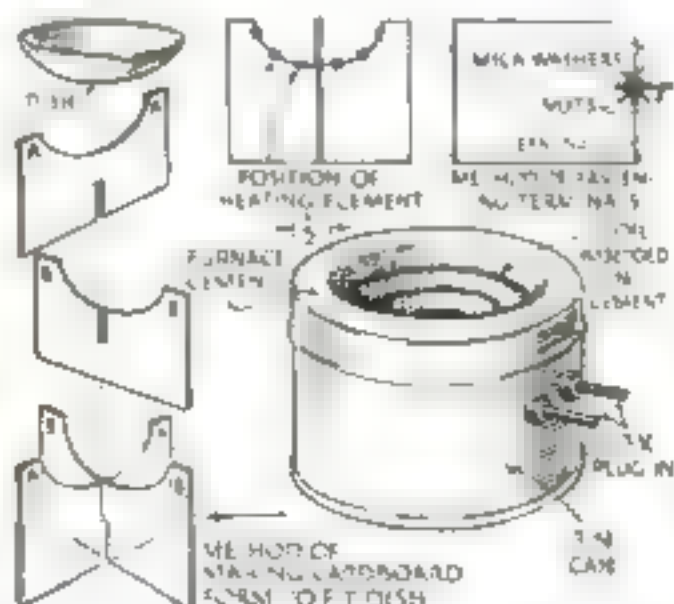
**F**EW materials are needed to construct the handy electric crucible or evaporating-dish heater illustrated. A tin can, a heating element, some wire, two connecting lugs, and some furnace cement complete the list.

Any shallow tin can having a large diameter can be used as the main container. The connecting lugs, obtainable from your neighborhood electrician or supply store, are the type used on electric irons and large heaters. The electric heating wire can either be bought or salvaged from a discarded 110-volt room heater or other appliance.

The heating element first is wound spiral fashion, on a form made by slitting a cross-shaped assembly of stiff cardboard. The ends of the heating element are in turn connected to the inside ends of the plug terminals soldered in holes



Placing the heating element in the tin can. Upper right the finished heater in use. The tongs are ten-cent pliers.



punched in the can. Then, with the heating element and its form in place inside the can, furnace cement is tamped in until it comes within a quarter inch or so of the heating element. After this layer of cement has been allowed to dry, more cement is applied and the finishing touches put on.

Finally, after a thorough drying, the heater is ready for use. If any cracks should form during the drying process, the surface should be wetted and patched with a new batch of the furnace cement. Lugs, cut from sheet iron, can be soldered to the bottom of the can as a finishing touch. If your laboratory lacks a pair of crucible tongs, a good substitute is available at most five- and ten-cent stores in the form of long-nosed pliers.

# Your Home Laboratory

1 meters of water, place the ferrous sulphate and the hydrochloric or sulphuric acid. The dye then should be dissolved in 200 cubic centimeters of water placed in a third container. When all three solutions are ready, mix them together and add the carbolic acid solution and enough additional water to bring the total solution up to about 1000 cubic centimeters in volume. A part of this water can be used to rinse out the containers.

Pour the resulting ink into a bottle, leaving practically no air space at the top, and stopper it tightly. The ink is then ready for aging, a process that may vary from twelve hours to several weeks. The longer the ink ages, the freer it will be of suspended particles.

**I**F YOU have followed the instructions carefully, your completed solution will be a good grade of ink, known to industrial chemists as blue-black iron gallo-tannic ink. The chemistry of this ink is easily understood. First of all, the ferrous sulphate combines to form iron tannate and iron galate when it comes in contact with the solution of tannic and gallic acids. When exposed to the air for some time, these substances turn black and are responsible for the black color the ink assumes after it has dried. The original blue color obtained when the ink flows from your pen comes from the blue dye. If a dye were not used, the writing would not be visible for several days until the iron compounds turned black. The hydrochloric or sulphuric acid serves to prevent the ink from forming a sediment, while the carbolic acid acts as a preservative to prevent mold.

Inks of other colors can be made by using different dyes. Violet, for instance, can be made by using methyl violet dye



In making ink and other things, a small balance is needed for weighing the chemicals. Papers are placed on both scales, and the material to be weighed is then conveyed to the pan upon a spatula. If a balance is not available, weights can be roughly gauged by measuring in a teaspoon.



A good ink will show no sediment after standing for twenty-four hours. Tests for fluidity and opaqueness are also made easily.

while black can be had by employing soluble nigrosine dye. Incidentally, nigrosine dye yields a legible ink when merely dissolved in water, but the resulting solution can hardly be classed as a permanent ink.

Although not exactly part of the ink manufacturing process, the standard tests used to determine the quality of ink form interesting experiments for the amateur ink maker. One simple yardstick of quality is known as the spreading or fluidity test. This is accomplished by allowing a definite volume of the ink, about five or six drops, to fall on a sheet of paper resting on a piece of glass inclined at forty-five degrees. The ink being tested should show approximately the same tendency to spread as other inks. Be sure, however, to use the same volume of each ink.

After a week or so of aging, homemade ink can be subjected to the opaqueness test to determine its blackness by comparing the various streaks obtained in the fluidity test. Also, by soaking the paper containing the streaks of ink in water, or a fifty-percent solution of denatured alcohol, for about twenty-four hours, some idea of the comparative weathering and

washability characteristics of the inks used can be obtained.

Once the theory of an iron ink is understood it is a simple matter to grasp the action of ink removers or eradicators. Most two-solution ink eradicators consist of a solution of bleaching powder in water and one of oxalic acid. In use, the bleaching powder solution is first daubed on the ink spot, allowed to remain a minute, and the surplus blotted off. Then, the oxalic acid solution is applied. The action of the two solutions is first to bleach the dye used in the ink and then to dissolve the iron compound. Another method of eradicating ink consists of soaking the spot with a one-percent solution of potassium permanganate and then following with sodium thiosulphate or "hypo" solution until the ink is colorless.

**BY MIXING** cream of tartar (potassium bitartrate) and potassium binoxalate to a paste, the home chemist can provide himself with an excellent remover of rust spots. Simply wet the fabric in the area of the spot and apply the paste. Soon the brown rust stain will become colorless and at this point the cloth should be rinsed in water. In using these chemicals, the amateur should remember that both binoxalates and oxalates are poisonous.

Even the manufacture of a good metal polish is entirely within the scope of the home laboratory. All that is required is some whiting, precipitated chalk, crocus martis (finely divided iron oxide), and ortho-dichlorobenzene. Mix the first three in equal quantities and then wet them with the ortho-dichlorobenzene. This will form a paste polish. If a liquid polish is desired, mix ortho-dichlorobenzene with an equal volume of oleic acid. Both polishes should be

(Continued on page 104)

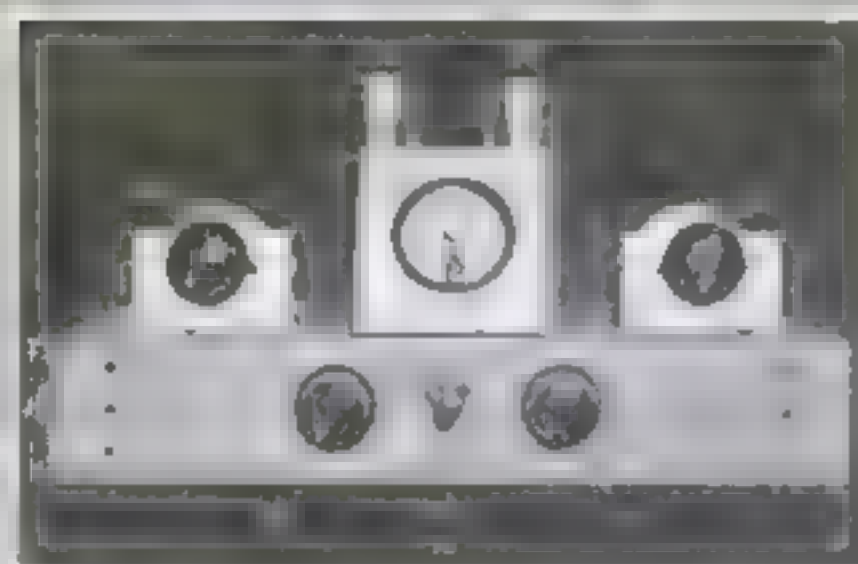


Skin-tight cappings may be placed on bottles by dipping the corked necks into a hot mixture of cooking gelatin, glycerin, and water.

# GET YOUR VOICE ON THE AIR WITH THIS Amateur

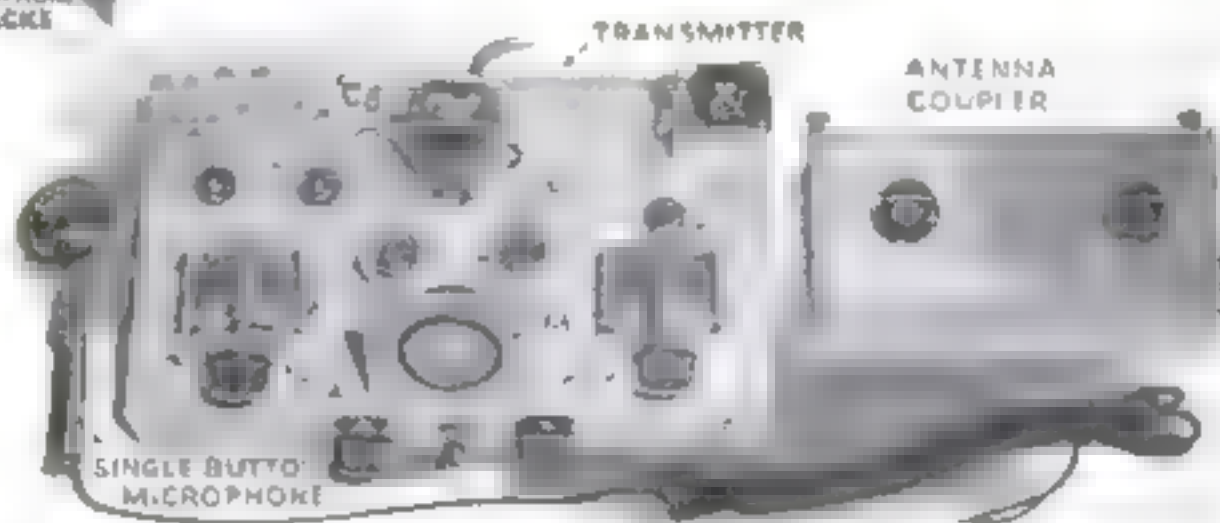


Below a 160-meter radio telephone chassis can be assembled complete for \$40. It uses receiver parts entirely.



How the various controls are mounted on the front of the chassis is shown in illustration above. Simple aluminum brackets hold the meter.

The oscillator circuit is crystal controlled; the crystal being mounted in the usual holder supplied with plugs so it can be removed.



By means of an antenna coupler the need for a special antenna for this transmitter is eliminated.

**I**F THE high cost of transmitters has kept you from owning your own short-wave station, here is your chance to build a first-class 160-meter radiotelephone for little more than the price of a good receiver. From the chassis up, this circuit has been designed for the beginner. Every drawback of the usual transmitter has been eliminated by careful planning. First of all, it is made up almost entirely of standard receiver parts which are both inexpensive and easily obtained. Second, it requires no complicated antenna system. And third, it is easy to adjust and simple to operate.

As the diagrams show, the transmitter makes use of four common types of receiver tubes. A type 50 serves as the crystal-controlled oscillator, a type 55 forms the buffer amplifier, and a pair of 2A5s in parallel act as the final stage. With the modern form of grid modulation employed, a single type 57 resistance-coupled amplifier provides adequate speech amplification for the single-button microphone used. The crystal in the oscillator is of the "Y" cut variety since it is substantially cheaper than the "X" cut and in this circuit gives equally good results.

With the exception of the power supply and the special antenna coupling unit, which will be described later, the transmitter is assembled on a 2½-by-8-by-14-in. chassis bent from aluminum. How the parts are arranged for convenience in wiring is shown in the photographs.

Mounted on the front, are the radio-frequency and audio-frequency gain controls ( $R_1$  and  $R_2$ ) and the plate switch ( $Sw$ ). On the top are two variable condensers, the 1,800-2,000-kilocycle crystal and its holder, the microphone transformer, the plate meter, and two tube sockets. At the rear are two microphone jacks, the output binding posts, and the power supply cable.

In the two and one-half-inch space under the chassis are the various coils, tube sockets, fixed condensers, fixed resistors, chokes, microphone battery, and connecting wires. The fixed condensers and resistors are self-mounted by means of the soldered connections to their partial terminals.

Composition tubing, one inch in outside diameter, is used for the coil forms.

Coil  $L_1$  consists of eighty turns of No. 26 wire on a three-inch form.  $L_2$  has seventy-five turns of No. 30 wire tapped at the fifteenth turn and wound on a two-and-one-quarter-inch form, while  $L_3$  contains 100 turns of No. 22 wire center-tapped and wound on a four-inch form. In each case the wire should be double silk covered.

It is not necessary to shield the coils, but they should be mounted at right angles to each other. Obviously, since  $L_3$  is the shortest one, it should be mounted with its axis vertical.  $L_1$  then can be placed horizontal and parallel to the side and  $L_2$  can be mounted horizontal and parallel to the front edge of the chassis. To provide rigid mountings, the coils should be held in place with small metal angle brackets soldered to the chassis.

An important supplementary unit of the transmitter is the simple antenna coupler consisting of two .0005-mfd variable condensers ( $C_1$  and  $C_2$ ) and an inductance or

# Phone Transmitter

By J. A. WORCESTER, JR.

coil ( $L_4$ ) made up of seventy-two turns of No. 22 D&C wire wound on a form one inch in diameter and three inches long. These units are mounted in a small 3-by-4½-by-8½-in. aluminum chassis furnished with two input binding posts and two output terminals (antenna and ground).

The purpose of the coupler is to provide a satisfactory connection or impedance-match between the transmitter's final amplifier and the antenna, thus eliminating the necessity of using a special antenna and complicated feeders or leads. With it any length of antenna, even a regular broadcast antenna, between twenty and sixty feet long can be used. It must be remembered, however, that it is always preferable to use a long, high wire, substantially clear of surrounding objects and having a lead-in that is short and direct.

If for any reason, you cannot rig a good single wire antenna, a doublet antenna with twisted or transposed feeders can be used. In this case, of course the ground connection is replaced by the second lead-in.

For the power circuit, almost any well-filtered broadcast power supply capable of furnishing at least 250 volts can be used. If one is not available, the amateur can construct a suitable unit for about six dollars. The supply shown, having a maximum output of 250 volts, which will give the transmitter a power output of approximately seven watts, is made up largely of receiver parts such as the amateur may have on hand. The transformer for instance, is of the common variety used in modern broadcast sets,

supplying 500 volts center-tapped at 100 milliamperes, five volts at two amperes for the '80 rectifier tube, and two and one half volts at eight amperes for the parallel-connected heaters of the tubes in the transmitter circuit.

Likewise, the chokes are of the readily obtained broadcast receiver type while the filter condensers are of the dry electrolytic variety available in a single compact

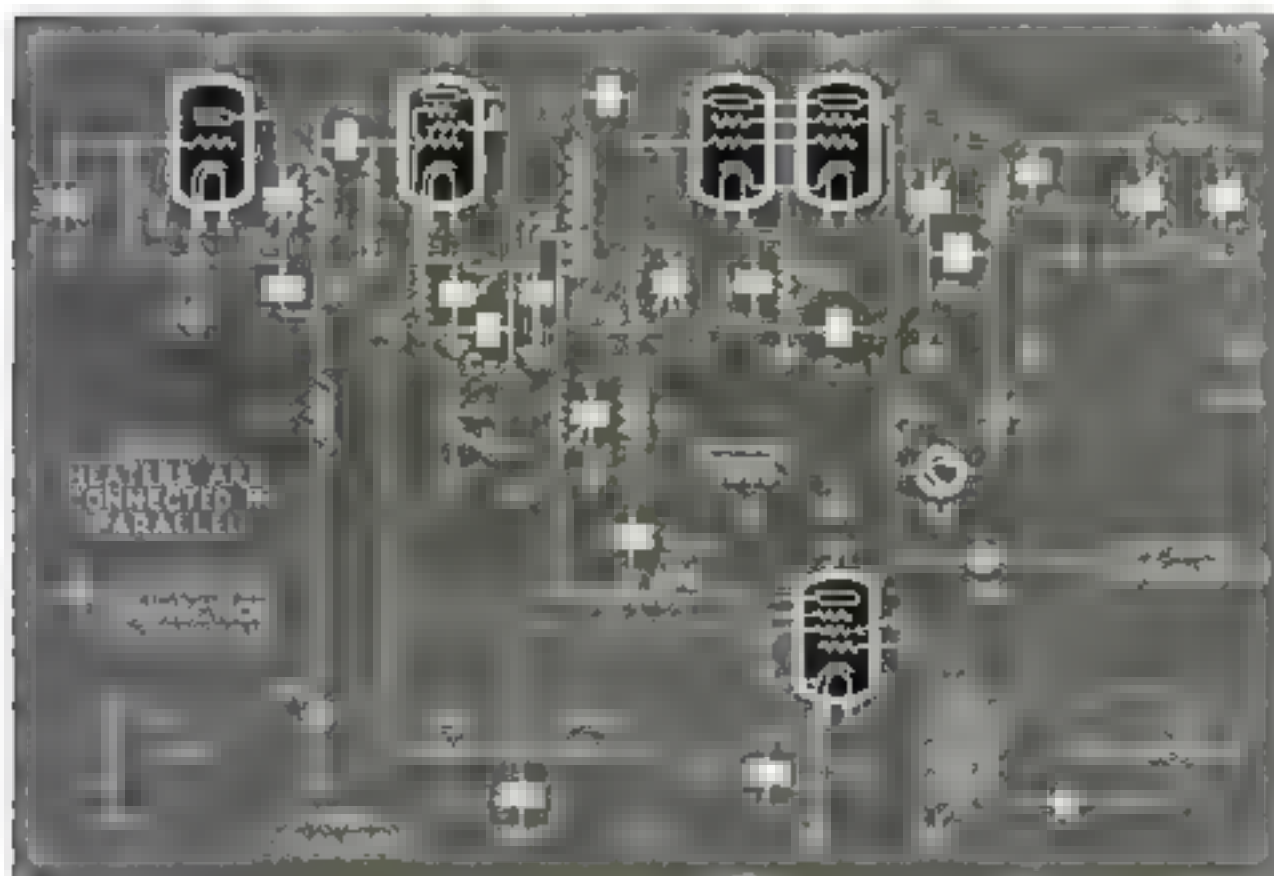
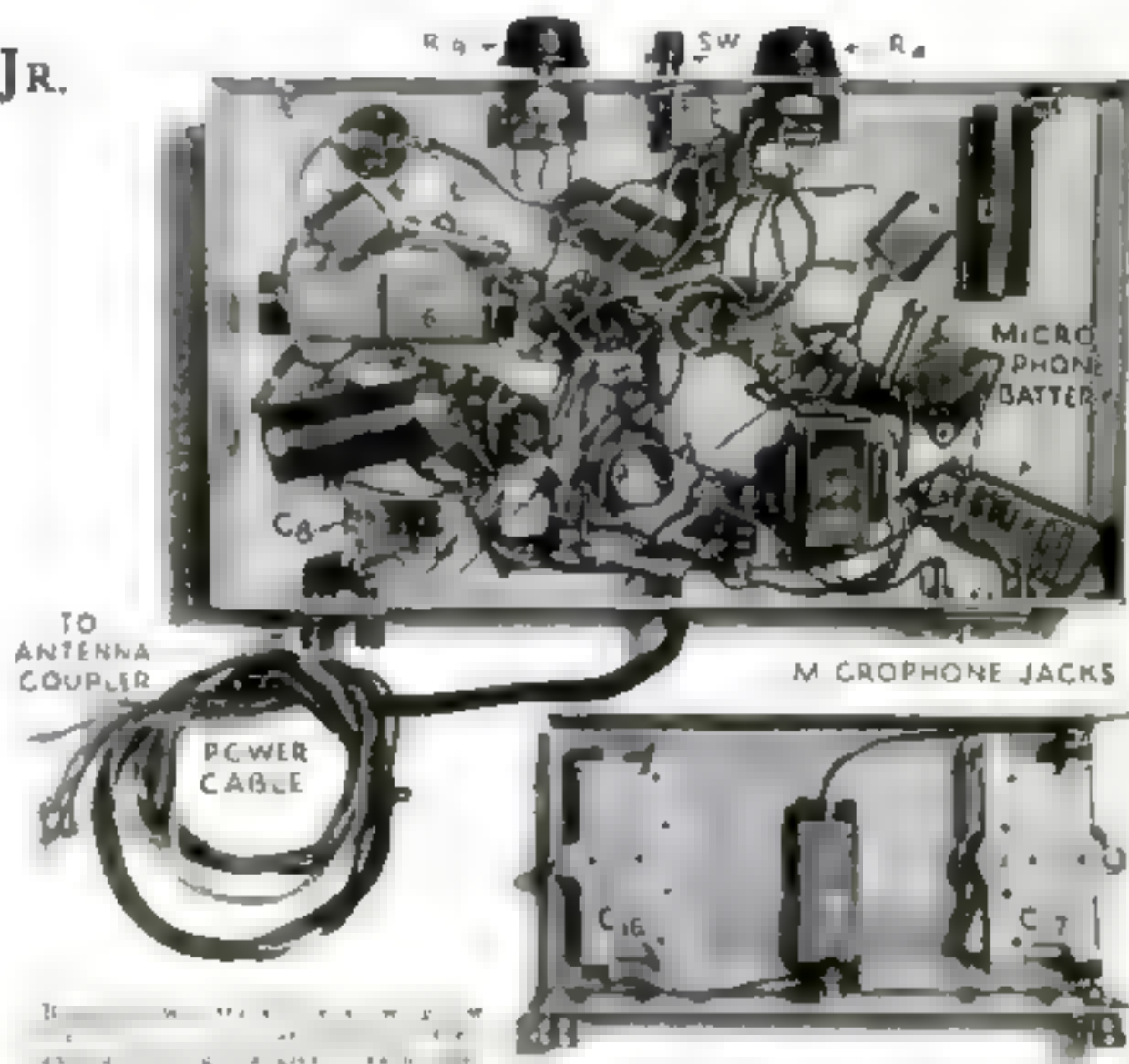
container. The parts can be mounted on a 2½-by-8-by-12-in. aluminum chassis.

In adjusting the transmitter, the amateur will have little difficulty if he follows a definite procedure.

The first problem is to neutralize the final amplifier. To do this, remove the crystal temporarily and connect an ordinary twenty-five-watt electric light bulb across the output terminals of the final amplifier. The power supply then should be turned on and the condenser  $C_{14}$  rotated. If the bulb glows at any setting of this condenser, or if the needle on the plate meter ( $M$ ) jumps, it is an indication that the final amplifier is oscillating. Condenser  $C_4$  then should be adjusted slowly with a screw driver until there is no motion of the meter needle during a complete revolution of condenser  $C_{14}$ . It will then be neutralized.

When the final amplifier has been adjusted, replace the crystal in its mounting and set the radio-frequency gain control ( $R_1$ ) at its maximum. Also, remove the electric light bulb from the output terminals and turn the condenser  $C_1$  to minimum capacity. Rotating condenser  $C_{14}$  then should produce a pronounced drop in the plate meter reading, indicating the point at which the tank circuit is in resonance with the frequency of the oscillator. If this condition is not obtained, condenser  $C_1$  should be turned in small steps until it is obtained.

The an- (Continued on page 106)



# New Dwarf Tube

## READY FOR AMATEUR



At right above is a large transmitting tube. Compare it with the tiny new tube which the young woman is holding. This is the smallest tube made but the other tubes it can be used for transmitting or receiving.



Although the 955 is not especially designed to be a transmitting tube, like the larger receiving tubes, it can be used in transmitters by amateurs. When used for this purpose, sufficient power output can be obtained to cover the line-of-sight distances usually associated with micro-wave transmissions. In the transmitter shown, it is used in a Hartley circuit for operation on the now popular one-meter band.

Because of its radical design, the 955 requires a special method of



Left: the internal construction of the new tube is shown. Note its resemblance to heater-type tubes.



Upper left: close-up of the new midget tube showing approximately its actual size. Above: the tiny tube and an acorn. Note the remarkable resemblance that gives the tube its name.

ONLY slightly larger than an acorn, and resembling it in shape, a radically new tube is now available to the amateur. Designed for use on the ultra-short waves between one-half and five meters, it opens a new field for experimenters in micro-wave reception and transmission.

Measuring less than an inch and a half in height, it more than justifies its title of "the world's tiniest practical radio tube." Yet inside its miniature acorn-shaped globe are a plate, grid, cathode, and heater that resemble the conventional elements in a full-sized three-electrode heater-type tube such as the common '27 or '37. These elements terminate in five prongs radiating from the base of the acorn like the fingers on a hand.

Designated as the 955 by the RCA Radiotron engineers who developed it, the tube is a challenge to radio fans interested in portable receivers, transmitters, and transceivers covering the ultra-short bands (P.S.M., Dec. '33, p. 53). It can be used as an oscillator and an amplifier as well as a detector, and operates on a six and three-tenths-volt heater current, either A.C. or D.C. and 180-volt plate current. According to its designers, the tube is the only triode capable of operating efficiently at frequencies under 60,000 (five meters).

An ultra-short wave receiver employing these acorn tubes, resembles the ordinary short-wave receiver with the exception that a special so-called tuned dipole antenna is used. As shown by the diagram, it is simply a regenerative detector feeding into a conventional resistance-coupled amplifier. When assembled for test, the parts were arranged in a midget three-by-six-inch cabinet with room to spare.

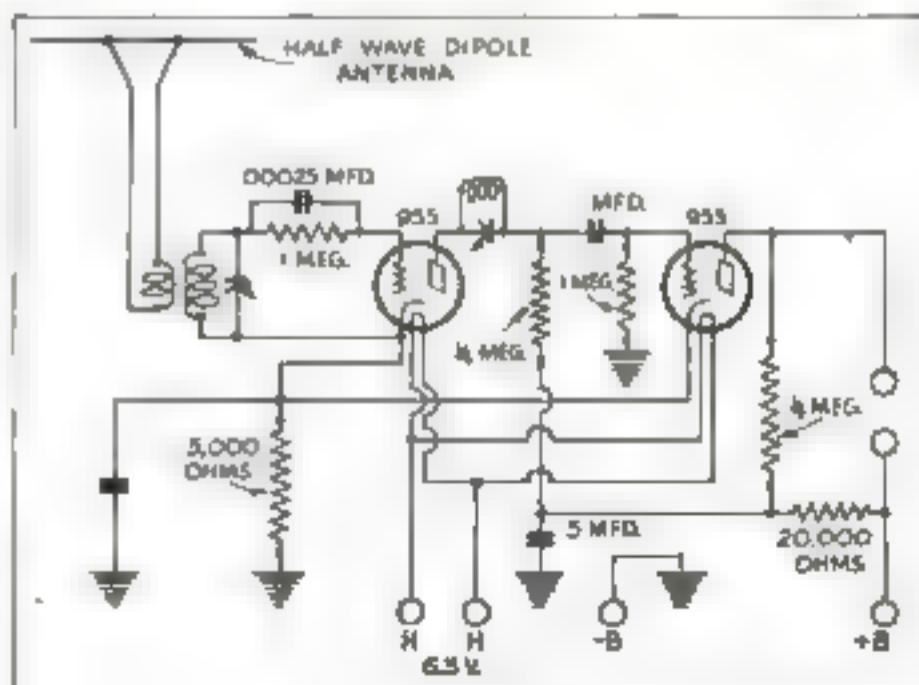


Above: tiny one-meter transmitter that uses the new tube. Note, ruler shows it is three inches wide.

mounting. This is done by means of five spring clips supplied with the tube. The clips, arranged to coincide with the five terminals that sprout from the sides of the tube, can be fastened to a supporting insulator of glass, mica, or other low-loss material. A hole, of course, must be cut in the mounting to take the bulging bottom of the tube.

Although not intended as a replacement for the large tubes in regular receivers, it does offer the experimenter a new unit that should serve as the basis for many novel circuits that will tell us more about the mysteries and possibilities of the ultra-short waves.

Right: diagram shows simple regenerative detector and resistance-coupled amplifier circuit used in one-meter receiver described in text.



**Question:** What is the moon made of? J. L., Dallas, Tex.

# Here's the Answer



**A.**—ACCORDING to noted astronomers, who base their theory on tests made with an instrument called a moon thermometer, the moon consists chiefly of pumice or some similar porous substance.

## Good for the Laundries

**Q.** P. T., PHILADELPHIA, PA. It is estimated that 70,000,000 tons of soot drop on American cities every year. Besides staining buildings, linen, and streets, it cuts off more than thirty percent of the sunshine.



## Hand Not A Foot As A Rule

**Q.**—WHAT is the standard "hand" measure used in measuring the height of a horse?—G. F., Sioux City, Iowa

**A.**—THE "hand" used in measuring horses is equivalent to four inches. To say that a horse is seventeen hands high means that he stands sixty-eight inches from the ground to the withers or peak of the front shoulders.

## Oiling the Waves

**Q.**—why does oil calm the sea?—F. G., Baltimore, Md.

**A.**—two properties of heavy oil are thought responsible for its calming effect on restless waters. It reduces the friction of the surface of the sea, making it easier for the wind to slip over the top, and its viscosity tends to hold the waves down and make them move more slowly.

## Sometimes the Plot Helps

**Q.**—how do they create the effect of fog in the movies?—Y. P., Seattle, Wash.

**A.**—one simple method consists of spraying a stream of vaporized oil into the blast from a powerful motor-driven propeller. The pro-

peller distributes the oil mist through the air and proper lighting makes it visible.

## Chained Status

**Q.**—why is a gasoline truck invariably fitted with a short chain that hangs down from the rear and drags along the road?—G. T., Sioux City, Iowa

**A.**—TIRES and other moving parts on a truck tend to generate static electricity. The short length of chain serves as a connection between the metal chassis and the ground to lead off any charge of static electricity that may develop and thus prevent it from accidentally causing a dangerous spark. If trucks used metal tires, the chain would not be necessary.

## Keep It In The Dark

**Q.**—why do automobiles seem pepper and smoother-running at night?—D. J. B., Hollywood, Calif.

**A.**—ACCORDING to experiments made by automotive engineers, a slight amount of water injected into the combustion chamber of any gasoline motor tends to improve its operation. It is thought that the oxygen supplied by the water aids the combustion. At night, or during misty or foggy weather, a certain amount of moisture undoubtedly is drawn into the cylinders of an automobile with the gas.



## Patching Camels

**Q.**—RECENTLY I read that camel's wounds never heal and that to cover the sore the animal's skin is patched with leather. Is that true?—C. W., Watertown, W. Va.

**A.**—ACCORDING to various camel authorities, there is no truth in the familiar statement that a camel's wounds never heal. However, camels do develop foot sores that often are

protected by sewing patches of leather to the pads on the bottom of the animal's feet. The leather serves more as a sole for a shoe than as a patch.

## Thundering Echoes

**H. P. G., CHICAGO, ILL.** The roar and rumble following a crash of thunder are echoes, sound waves reflected by the earth and clouds. A large shell or bomb, if exploded high enough in the air, would have the same effect. Sound waves travel 1,090 feet a second at a temperature of zero Fahrenheit.

## Racing Neck and Neck

**G. A. S., JR., PORTO DE LIERNA, PORTO RICO.** Radio waves are considered as having the same speed as light—approximately 186,171 miles a second.

## Ink for Stencils

**M. J. B., EAST ORANGE, N. J.** To be suitable for use with stencils, an ink must be thick, more like a paste than a fluid. A satisfactory ink of this type can be made by mixing the following: Shellac (two ounces), borax (two ounces), water (twenty-five ounces), gum arabic (two ounces), and enough Venetian red, lamp black, or Prussian blue to give the desired color. Boil the shellac and the borax in some water to dissolve them. Then add the gum arabic, discontinue the heating, and when the solution has cooled add enough additional water and coloring to bring the ink to the right consistency.



## A Question of Ears

**H. K., BALOWIN, L. I., N. Y.** One feature that distinguishes the Indian elephant from its African brother is the size of its ears. The African elephant's ears are large while those of the Indian variety are comparatively small. Also, the hind feet of the Asiatic variety usually have four toenails each while the African variety have but three.

## Climate and Trees

**Q.**—how do scientists determine the past climate of a certain locality?—L. V., Richmond, Va.

**A.**—one way is by studying the annual rings in the trunks of old trees. The more rain during a certain year, the wider the ring of growth. In California, for example, many trees are more than 3,000 years old and by their rings much can be told of the climate in that vicinity during the time of Christ.

## Why Leaves Turn

**Q.**—what causes the leaves of a tree to turn red and brown in the autumn?—P. Z., Boston, Mass.

**A.**—CHEMISTRY plays a large part in the turning of the leaves when cold weather sets in. First of all, the original green color of leaves is due to a substance called chlorophyll. In the fall, lower temperatures and less sun cause this chlorophyll to change into a red-brown compound. (Continued on page 90)

# Car's Rattles

FOUND BY TOUCH SYSTEM

Gus grasped the bumper and started shaking the car. "Listen," he said, and the clack-clack previously heard came from the springs.

clattering noises that all but drowned out the doctor's booming voice.

"Just three things are making an anvil chorus out of this car," explained Gus after a thorough inspection of the car back at the Model Garage. "A loose radiator stay rod, tight floor boards combined with loose body bolts, and loose spring shackles."

Dr. Pearson looked at him blankly. "Now how in the world can a floor board make a noise when it's tight," he asked.

"Simple enough," answered Gus. "In the first place, the frame on any car weaves a bit when it's driven over an uneven road. If the body bolts are loose the body twists even more, pushing the floor boards with it. Naturally, if the boards are fastened tightly at both ends, they can't move, so they strain and twist. The result is that pop you've been hearing. Loosening one end of the floor-board section will fix it."

"But won't they rattle if they're loose?" asked the doctor.

"I won't loosen them that much," replied Gus. "Just enough to allow a little play at one end. Then I'll give the ledges they rest on a good dose of heavy oil and finish up by tightening the body bolts."

"Certainly sounded like a door rattle," Dr. Pearson insisted.

"That just proves you can do a sight more with touch than you can with your ears when it comes to tracing rattles and squeaks in a car," smiled Gus. "Car noises are funny things. They have a way of scooting through the frame or the body till they reach a broad surface that acts as a sounding board. Your ears will place the noise at the sounding board but your finger tips will trace it to the source. Just as an example, start up your motor and listen. Do you hear anything?"

"Yeah," the doctor agreed. "Sort of a rapid-fire rattle."

"Where does it sound like it's coming from," asked Gus.

The elderly physician scratched his head. "Sounds like the instrument panel to me," he ventured. (Continued on page 103)

By MARTIN BUNN

"CONFOUND that noise," exclaimed the elderly Dr. Pearson as he thumped the steering wheel with his fist. His wife, seated beside him, touched his arm soothingly. "Now don't get so excited, Frank," she said. "A few rattles aren't hurting anything. Most of it's your imagination anyway."

"Imagination be hanged," grumbled the doctor. "Sounds like the car is falling to pieces every time we hit a pebble, and that eternal popping noise in the door is driving me crazy." Just then Mrs. Pearson noticed a squat building further on down the street. Above it hung a large sign that read: "Model Garage—Auto Service and Repair."

"There's a nice-looking garage," she said. "Why don't you stop? Maybe they can locate the trouble. I'll do some shopping while you wait."

A few minutes later, Dr. Pearson was telling his tale of woe to a gray-haired mechanic who had introduced himself as Gus Wilson.

"Doesn't look like a rattle box," remarked Gus, eyeing the car. "But if it has 'em, we'll get rid of 'em. Start the motor for a minute."

"The motor's all right," protested Pearson, reaching for the ignition switch. "It's the body that's making the noise." When the motor settled to an even purr, Gus lifted

the hood and moved his hand from one part to another. He seemed particularly interested in the cowl wall at the back of the engine block and ran the palm of his hand over the flat surface several times before he finally refastened the hood.

"O. K. Now if you've no objections, suppose we go for a little ride," he said, climbing into the seat beside the physician. "Let's go up the street for a few blocks and drive out the old station road. That'll be a good test."

As the car gained speed, a series of sharp raps or pops occurred each time the wheels hit any unevenness in the pavement. They were neither rattles nor squeaks, but more like creaks.

"There's that popping noise I told you about," the old man sputtered. "That racket keeps up indefinitely. Sounds as though it came from this side of the car, but I'll be hanged if I can find it."

Without answering, Gus moved his hand over the instrument panel, along the base of the driver's seat, and finally over the floor boards.

"It isn't the floor boards," said Dr. Pearson positively. "I've got them so tight now I'll need a crowbar to pry them loose."

By this time, the car was jouncing along the poorly paved road that led to the railroad station. Bouncing from bump to bump, it gave forth a new assortment of

## GUS says:

If you hate the hard work of polishing or waxing your car, at least take the trouble to keep the hood in shape. Remember, it gets the brunt of the weather and a continuous baking from the heat of the motor. It doesn't take long for dirt and tar to bake on so hard that it takes more than just a casual rubbing to remove them. The sap that drops from trees also is particularly hard to remove once it is baked in place.



## BRILLIANT "Stained Glass" Windows

MADE WITH ONLY A PENKNIFE

**W**INDOWS that rival genuine stained glass in beauty can be made easily and inexpensively by using colored cellophane. The design is merely cut out with a sharp penknife and sandwiched between two pieces of translucent rippled glass.

The method is so simple that you can prepare any type of design you please and incorporate your monogram or any other emblem. Nevertheless, the finished effect is of extraordinary brilliance. It may even surpass windows made of separate pieces of colored glass in the ordinary way, in spite of their costly materials and the painstaking craftsmanship and long experience required in their construction.

*By Eric  
Munsinger*

The design is cut from sheets of colored cellophane and set between panes of translucent glass, rippled on the outside.



glass. This is done by using so-called "cold" or "liquid" solder to form lines in imitation of leading.

In addition to the window that will be described in detail two supplementary designs without dimensions are shown in the drawings at the top of the following page. Most books on heraldry or stained glass contain illustrations and suggestions for various other designs. The reader, however,

will probably prefer to use his initiative so far as to incorporate his initials or coat of arms into the pattern. Lodge, club, and school emblems also make excellent subjects.

For the window made by the author, the following materials were used: Two sheets of translucent glass, 15 by 20 in., each having one smooth and one rippled surface. (These should be as thin as obtainable.) Four rolls of colored cellophane—red, purple, yellow, and green. A few large sheets of white bond paper;

There is something particularly clean-cut and modern about windows made in this way. They have the clear, unobstructed surfaces that are characteristic of modern furniture and buildings. If, however, an antique effect is desired, it is a simple matter to give the appearance of separate panes of leaded



ST. MICHAEL'S

### HERALDIC DESIGNS

The following designs were used by the author in constructing the window illustrated. The designs are cellophane cut-outs. As shown in the illustration, a pattern is placed between the glass panes and secured by the use of the solder.



UNIQUE NEW METHOD USES TRANSPARENT CUT-OUTS  
SANDWICHED BETWEEN PANES OF RIPPLED GLASS

a little transparent (liquid) glue, and some glass or celluloid cement.

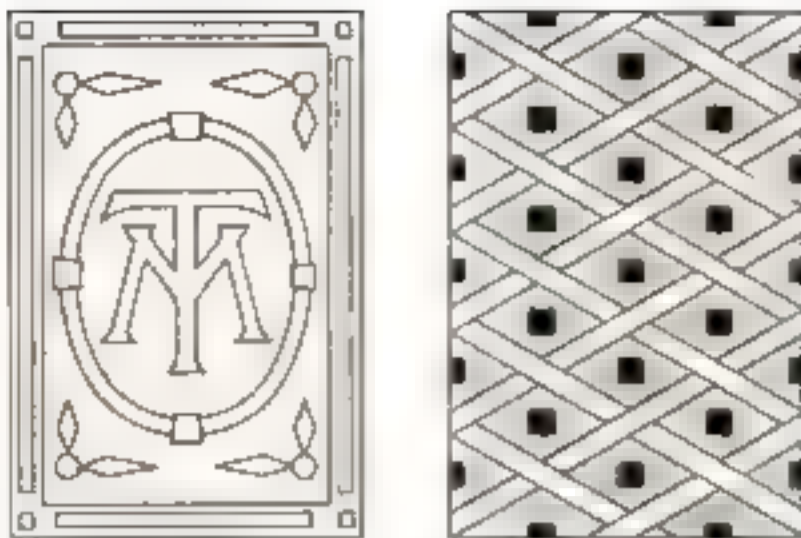
Draw two copies of the design pattern actual size preferably with India ink. Mark on each section of each design the color it is to be.

Lay a sheet of cardboard or several thicknesses of paper upon your drawing board or table, and place one sheet of each color of cellophane upon this. Now lay one of the patterns upon the whole, smooth it all out well so that there are absolutely no wrinkles in the cellophane, and fasten securely around the edge with thumb tacks.

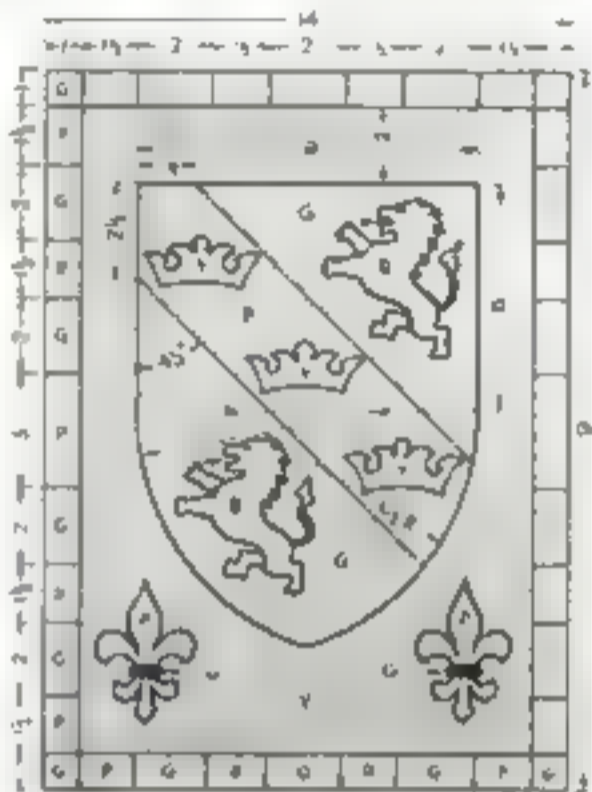
Using a small, very sharp penknife (or the corner of a razor blade), cut out all the different sections of the design. Set aside the pieces of the desired colors for each section, putting them separately between the pages of a book, and keep the border pieces in their correct order. The rest may be discarded. Cutting all colors at once in this manner facilitates the work and insures that the sections will fit together perfectly. The cutting should be begun from the center to avoid disarranging the different sheets, since they are fastened only at the border.

Next take the other pattern and put one sheet of glass, smooth side up, upon it. The design is, of course, clearly visible through the glass. Using it as a guide, fit the sections of cellophane in their places. Tack them down in a few spots along the edges with the transparent glue. Small tweezers will prevent finger marks on the cellophane and make the handling easier.

When the picture is complete, lay the



Suggestion for a monogrammed window that will give an individual touch to any entrance hall, and a pattern for blue and gold latticework with red squares on a green background.



other sheet of glass on top, smooth side down, and cement the two around the



All colors are cut simultaneously so they will be even in fit. At left: Layout for the window described. The green parts are marked G, purple P, red R, and yellow Y.

edges to hold them firmly together and keep out moisture.

Those who desire to make a perfect replica of a genuine stained glass window may do so by applying liquid solder to the outside surface in narrow lines, between the different colors, to simulate leading. Although this may give the pane a more genuine appearance, the author believes it detracts from its beauty, since the original purpose of the lead was merely to fasten the separate pieces of glass together.

The "stained glass" is fitted into the window sash like any ordinary pane.

## Handmade Rings and Bracelets Look Like Buckled Belts

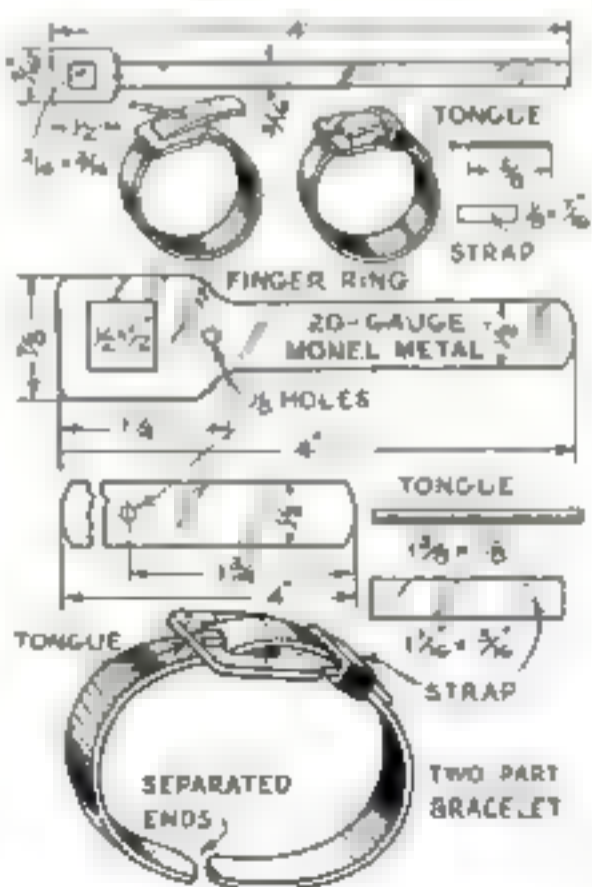
**B**ELT-BUCKLE rings and bracelets are a novel form of jewelry that can be made with very few tools by beginners in decorative metal work.

In making the ring, obtain a piece of 20-gauge monel metal and cut out the blank as shown. Drill a small hole, 1/16 in. in diameter or less, where indicated. Bend the metal in a circle, push the small end through the square hole, and adjust to the desired size by shaping over a ring mandrel or a tapering piece of round iron or wood. Drill a hole for the tongue of the buckle. Make the tongue from a piece of the same metal and bend one end at right angles, the bent portion being about 1/16 in. long.

Insert the straight end of the tongue through the hole in the belt; then stick the bent end into the hole drilled in the buckle. Place the ring on the mandrel and hammer the end of the belt into place. Place the strap, bent U-shaped, over both thicknesses of the belt, and with pliers clamp the ends on the inside of the ring. File off the tongue of the buckle to the proper length and push the ring on a buffing wheel, using jeweler's rouge.

In making the bracelet, two strips of metal are used. Stick the end of the plain piece—the end nearest which the 3/8-in. hole has been drilled—through the buckle.

insert tongue, and clamp together as in making the ring. Sweat the two pieces together with solder, and solder the end of the tongue to the buckle. If the band



works loose while making the bracelet solder it on also. Bend the outer ends around in a circle and shape until the bracelet fits the arm.

If a bracelet with more spring is desired, use 20-gauge German (nickel) silver instead of monel metal. A contrast may be had by making the bands of German silver and the buckle tongue and strap of monel.

If desired, both ring and bracelet can be planished with a small ball-peen hammer, or designs can be cut or stamped into the metal.—W. T. BAXTER



These pieces of jewelry are original and decorative, yet comparatively easy to make.

PANELS OF GLEAMING BRASS SET OFF THIS

# Decorative Wastebasket

*A design that will show your skill  
without costing much for materials*

**By J. I. SOWERS**

*Director of Industrial Arts  
Miami Evening Schools, Miami, Fla.*

In style, novelty, and workmanship this wastebasket is far superior to ordinary designs made for use rather than beauty. The plans appear at right.



**I**T IS usually difficult to purchase a correctly styled basket for waste paper. That this article of furniture should fit in with the general scheme of room decoration is a matter which seems to be given little thought. The Colonial design illustrated above lifts this neglected article into a class with other well-designed pieces and makes it a thing of beauty as well as use.

Select a wood in harmony with the Colonial design such as walnut or cherry. If these woods are difficult to obtain, others may be used and stained and finished to imitate them. Both red gum and mahogany take a good walnut stain. Oak, too, may be used and stained brown, but it is less desirable for Colonial type furniture.

Work out the four uprights first, these are  $1\frac{1}{4}$  in. square and  $16\frac{1}{4}$  in. long. After squaring up this stock, cut it to about 17 in. long to provide waste stock at the ends for turning. As will be seen in detail drawing D, the base turning is larger than the rest of the upright. In order to make this turning, extra stock will have to be glued to each upright as shown at G. Care should be taken to produce a good, sharp, accurate piece of turning.

The next step is to make the side rails, which are fastened with mortise and tenon joints, as in the assembly drawing B. To simplify the work a little,  $\frac{3}{8}$ -in. dowel fastenings may be used instead, however, the mortise and tenon joint makes the best fastening and is more truly Colonial. It certainly should be used if one has machine tools.

Two of the upper side rails are shaped into handles as shown at A. The boring should, of course, be done from both sides to avoid splitting.

The two bottom rails are grooved to receive the panels, as are also the uprights.

The panels, as shown at E, are made of  $\frac{1}{4}$ -in. stock backed by a sheet of tin. Four small pieces of 20-gauge brass are soldered to a tin backing sheet in such a way as to show through the openings in the panels. If it is not convenient to solder these pieces of brass to the tin, they may

be attached as shown at F. The brass is polished with a piece of fine sandpaper or with fine steel wool and given a coat of clear lacquer to prevent tarnishing. This is done before the work is assembled.

The design for cutting out the wood panels is only a suggestion, any other suitable pattern may be used, provided it is in harmony with Colonial design.

The bottom is a piece of sheet tin, tacked in place with  $\frac{3}{16}$ -in. No. 14 brass escutcheon pins as shown at C. After the piece is assembled, the tin back of the panels and the bottom are painted with dull black paint.

The finished piece is stained with walnut oil stain and given a thin wash coat of shellac. This is ordinary shellac thinned with four parts alcohol. After this it should be given an oil finish. Early cabinetmakers produced this finish by applications of raw linseed oil. The oil is applied frequently during a period of a number of days; and each application is allowed to dry about one hour and then thoroughly rubbed off. This eventually makes the most beautiful and durable finish that can be applied to wood. Any good book on wood finishing will give more information about oil finishes. If this finish is not used, however, the piece may

be varnished and given a rubbed finish with pumice stone. In no case should the finish be brought to a high polish. Newness is to be avoided. Try to give the work an appearance of age.

## HOT OIL PRESERVES HARDWOOD

A DURABLE, climateproof, antique finish may be given walnut and other hardwoods by pouring boiling-hot linseed oil over the unfinished wood. The surface is then sanded or rubbed to a smooth finish, and the process repeated until the wood is as dark as desired. It is then polished with wax.—L. W. HENDERSON.

## SOLDERING GALVANIZED IRON JOINTS

**A**FTER constructing an aquarium frame out of galvanized iron, I learned that the strength of any galvanized iron parts soldered together by the usual methods is no greater than the adhesion

of the galvanizing itself. A sufficient strain upon the solder will pull the galvanizing off the metal.

This limitation is easily overcome by drilling one or more small holes through the two parts before soldering. Fill the holes with solder, and you have what is virtually a rivet of solder. In soldering galvanized iron, use undiluted muriatic acid.—JOHN EDWIN HOGG.



# Making a WIND GAUGE



The gauge may be mounted on a roof and the dial placed directly underneath, or it may be used as a portable instrument with the dial reversed and facing upward.

dimensions are materially changed, the calibration formula is likely to be inaccurate. The entire value of the instrument depends upon the care and accuracy with which it is calibrated.

To bend the vanes, clamp a wooden rod about 2 in. in diameter in a vise and rub the blanks over it with a sidewise motion to start the bends. Then rub them with a cloth pad. Avoid kinks, as these change their reaction to the wind.

After soldering the cross arms together, cut the two center plates and form the channels by laying the

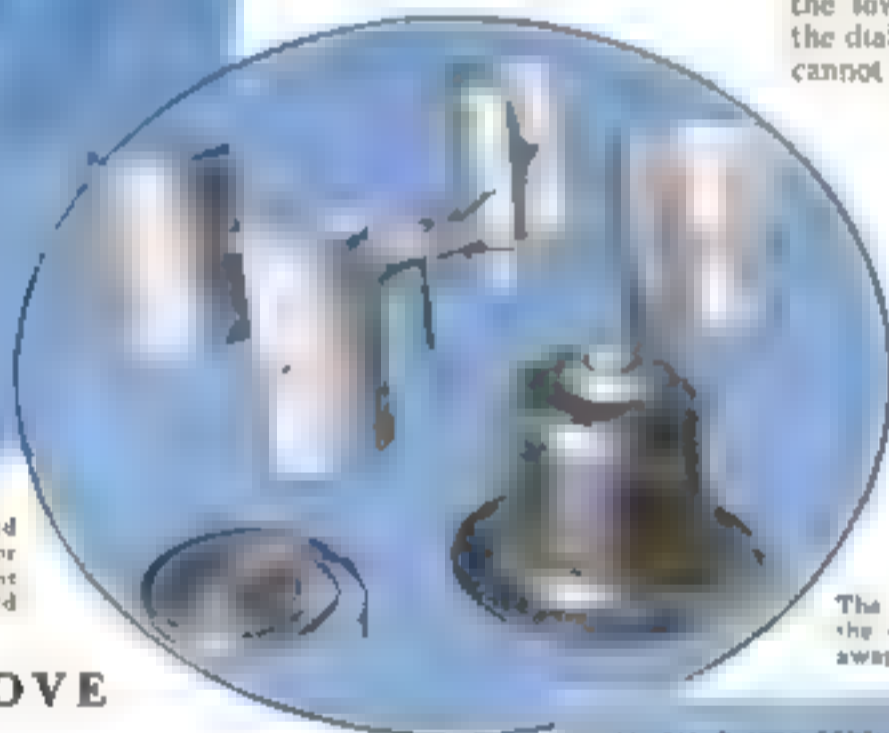
*A highly simplified anemometer in which the vanes do not spin, but turn against the torsion of a spring*

top with a cold chisel and solder the skate wheel over it as shown below.

The clock spring must be at least  $\frac{1}{4}$  in. wide. If very high velocities are common two, three, or four springs will have to be ganged together. The cross arms then should be made of heavier material to resist the strain. This, of course, cuts out the lower velocities, since the points on the dial will be so close together that they cannot be read, yet, even so, it is likely that breezes of five miles would be indicated.

Break off enough of the spring that it can be entered in the housing without rubbing much on itself. Punch a hole in the outer end, and drill one in the housing to receive a bolt.

Set the spindle in the bearing cup on the bushing installed the spring and washer, and tighten the nut, burring the end of the spindle to prevent loosening. Drill a  $\frac{1}{8}$  in. hole for



The drawings below show a side view of the complete installation and a broken-away top view of arms, vanes, and housing.

BY EDWIN M. LOVE

A 23-MILE wind tore at the Mt. Washington N. H., meteorological station not long ago. The pressure on the cabin must have been more than 240 lb. per square foot, and the force against a section of wall 8 by 10 ft. at least  $9\frac{1}{2}$  tons!

It is always interesting to speculate on the velocity of the wind, whether a gentle breath that ripples the water and makes the leaves dance, or a rending gale that lifts roofs and rips branches from the trees. From odds and ends you can build an anemometer that will indicate this velocity provided it is properly calibrated more accurately than the speedometer on your automobile usually registers your driving speed.

This meter does not spin continuously, but is of the direct-reading pressure type, with cup vanes that revolve in the wind against the torsion of a spring until the two forces balance. The drawings show the construction clearly, but a few points must be especially noted. It should be remembered that each anemometer has its special characteristics, so that if any di-

Assembled vanes, the horn-motor cover that serves as a support, and the clock spring, which is set inside the housing.

plates on a pine block and hammering with a rounded cold chisel. When the two are done, bolt them to the arms and solder solidly.

Now drill for the spindle, solder it in, and solder the cups on. Balance the assembly by driving solder into the light ends of the arm tubes.

The spindle bearing is a skate wheel which costs about 1 cent at a hardware store. Select one with a minimum of side play.

From an automobile wrecking yard obtain a horn-motor cover having a flange so that it can be bolted directly to the base. Chop a hole in the

CENTER PLATES SCREWED TO MACHINE



the index-hand spindle. Solder on the tin-can roof.

The instrument is now ready for calibrating. Solder a stiff wire to the edge of one vane to act as a pointer, and stand the apparatus on a piece of paper on a table in a room free from drafts, so that the zero point can be located. Mark this with a pencil. Now tie a string loop to the hook of light spring scales, slip the loop under a vane and adjust the scales to pull at right angles to the center, and draw the arm around until the reading is  $\frac{1}{2}$  oz. Take a similar reading at 1,  $1\frac{1}{2}$  and 2 oz. Now check these readings with each other and if the marks on the dial are not equidistant take new readings. The scales must be at right angles to the vanes.

If suitable scales are not available you may make a substitute by tacking a rubber band to a strip of wood. Tie a loop of string to the free end of the rubber, load it with a  $\frac{1}{2}$ -oz. weight and mark the position of the knot on the wood. Do the same for 1,  $1\frac{1}{2}$  and 2 oz. Then use this device for calibrating the anemometer as shown in the photograph at the bottom of this page.

Dismount the anemometer and draw four circles as shown. Four are necessary because the vanes when registering up to 45 m.p.h. sweep four times around the dial. The division points may be calculated according to this formula, which is much easier to work out than may appear at first glance:  $d = DA^2/2011.35$ , where 'd' stands for degrees, 'D' represents degrees deflection obtained with a pull of 1 oz., 'A' is the average area of the vanes and 'V' is an assumed velocity.

To illustrate: The length and breadth (diameter) of all vanes multiplied together, added then divided by four to get the average = 12.9 = A. Deflection in degrees with 1 oz. pull = 101.25 = D. Assume a wind velocity, say 23 m.p.h. Then  $d = 101.25 \times 12.9 \times 23 \times 23 \div 2011.35 = 324.6$  degrees.



## SET UP A LITTLE WEATHER BUREAU OF YOUR OWN

**W**EATHER is the one great universal topic of conversation. Is it going to snow? Will it get warmer? Is a storm blowing up? Will there be a heavy frost tonight? You are always asking these and countless other questions, and talking about them to your friends. Why not make a real hobby out of the weather and start a little weather bureau of your own? As soon as you have a few instruments, you will find it fascinating to watch them, and you will quickly learn to forecast changes in the weather with surprising accuracy.

Much can be done with three instruments—a high grade thermometer, a barometer, and a hygrometer. These are available everywhere and do not cost a great deal. If you are handy with tools, you can make an anemometer as described in the accompanying article, and other instruments may also be constructed as your weather bureau expands. You will also need to consult the daily government weather map. It is now published regularly in some of the larger newspapers and usually can be seen at post offices or public libraries if you do not wish to subscribe for it yourself. And, of course, you can listen to detailed weather reports over the radio.

Do you want to try this hobby? If so, send a post card to the Home Workshop Department with a request for more articles on weather. Please indicate whether you would like to make a maximum and minimum thermometer, a mercury barometer, a hygrometer, or a seismograph.

It is unnecessary to do all this multiplication every time a point is calculated.  $DA/2011.35$  occurs every time; therefore obtain this amount and multiply the  $V^2$  by it. Again illustrating, with my anemometer,  $101.25 \times 12.9 \div 2011.35 = 0.614$ , and the formula becomes  $d = 0.614 V^2$ .

A table of squares is appended, which will save the trouble of squaring V.

If you have a slide rule, set 1 on scale C over  $DA/2011.35$  on scale D, with the rider glass over  $V^2$  on scale C, and read the deflection beneath on scale D. After this, to read off a new deflection, it is necessary only to slide the rider to a new  $V^2$  on C, and read from D.

Use a protractor to locate the points on the dial. When (Continued on page 87)

Calibrating dial with telltale to indicate which circle to read. Construction details and a self-measuring deflection with improvised scales made from a rubber band and stick of wood. Such scales, of course, must be calibrated in advance by the use of druggists' weights.

# Rubber Band Pistol

LOOKS LIKE REAL "GAT"



**H**ERE is a wooden automatic pistol that looks like the real thing and shoots rubber bands with surprising accuracy.

Obtain three pieces of clear white pine  $\frac{1}{4}$  by 3 by 10 in. and fasten them together with a few brads. Lay out a full-size plan of the pistol and transfer the drawing to the top board with carbon paper. Saw all three pieces at one time on the outside lines. Then separate them and from the top and bottom pieces cut away the trigger guard and hammer.

Lay out the combined trigger and hammer on the center piece and saw it out. Also saw out the trigger guard, taking great care not to break it. If the trigger guard is shellacked as soon as it is sawed out, it will be less likely to break. Rub the trigger-hammer combination flat on a sheet of fine sandpaper, thinning it down from both sides so that when assembled it will move freely between the other pieces. A small coil spring from a baby battery clip, sold in the ten-cent stores or from any other source, is used

The pieces that have no hammer or trigger guard form the side plates. Between them is set the piece with the trigger guard. In the opening of this part is placed the combined trigger and hammer. At right is the gun ready to shoot.



as shown to hold it in the forward position.

Glue the center section, without the trigger-hammer combination of course, to the right-hand piece and let it dry under a weight.

Now assemble the pistol, attaching the left hand to the other two with three small screws. Then round, shape, and smooth the weapon to its final form. Give it a coat of shellac and, when dry, sand it to a very smooth finish. Mix a little lampblack with some blue paint until about the color of blue steel and paint the gun. The handle plates may be marked out and painted brown, if desired.

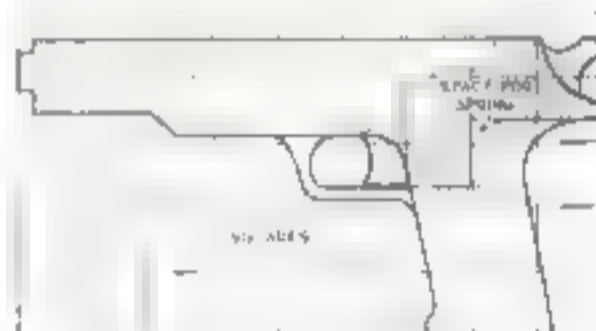


Pistol with one side plate removed and, at left, the finished gun.

To load, pull the trigger to raise the hammer and insert the doubled end of a rubber band in front of the hammer. Let the hammer down on it, then draw the other end down over the muzzle end. A pull on the trigger will shoot the band a good distance.—CLARK H. KUTTER



Pulling the trigger moves the hammer back and lets the end of the rubber snap forward.



## FOLDING PORTRAIT REFLECTOR

THIS compact portrait reflector will be appreciated by amateur photographers because it can be folded up and is light in weight. Four pieces of heavy corrugated board are cut to the same size—in this case, 12 by 30 in. Twelve strips of muslin are then glued as shown to form hinges.

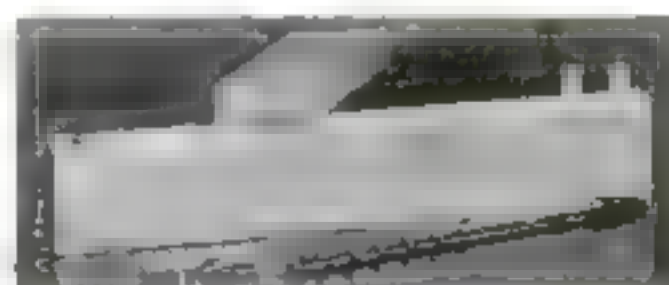
After the glue has dried overnight, sheet tin foil is glued on one side of the reflector. The tin foil may be obtained at any photo supply store at trifling cost. The back may be covered with some dark material, if desired, for use as a background when needed.—JOSEPH KEMP

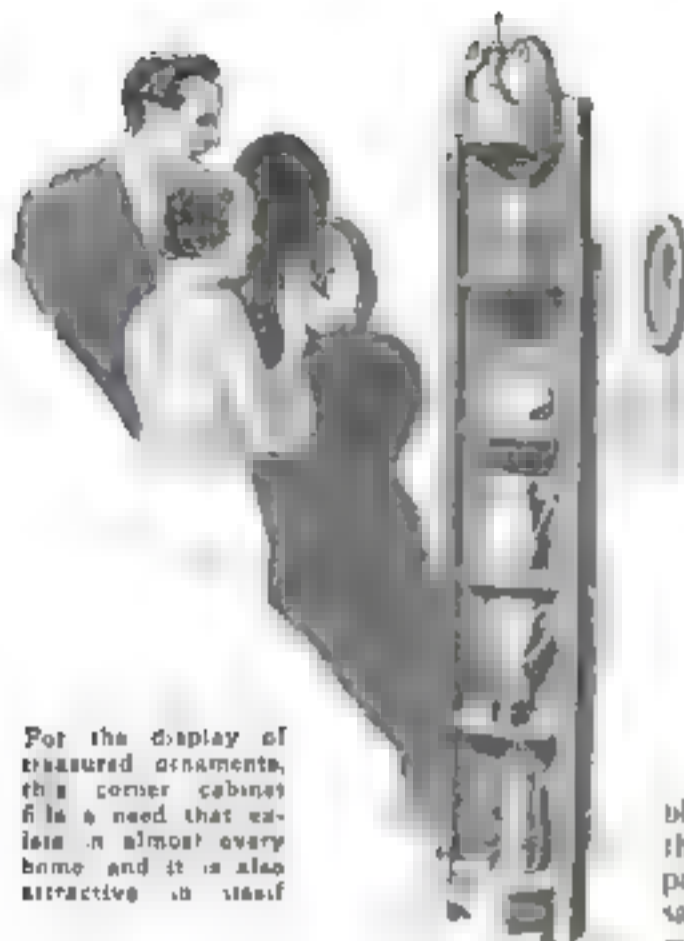


## QUICK WAYS TO MARK DOWEL HOLES

ALTHOUGH few beginners in woodwork are familiar with them, the small steel markers known as "dowel centers" save much time in making blind dowel joints. The holes are first bored in one of the pieces to be joined. Then dowel centers of the same size are inserted in the holes as shown at the left of the photograph below and the joining piece is placed in position and pressed against the sharp points. The resulting indentations show where to bore the matching holes.—W. H. McCLELLAN

When dowel centers are not at hand, marks for boring both sets of holes can be made simultaneously in the two pieces by using ordinary pins. Hold one of the pieces in the vise with the joint edge horizontal and lay pins on the edge with their heads where the centers of the dowel holes are to come. Then carefully press the second piece in position without disturbing the pins.—A. W.





For the display of treasured ornaments, this corner cabinet fills a need that exists in almost every home and it is also attractive in itself.

# Graceful but Easy to Build... A Colonial Corner Cabinet

Designed By  
FRANKLIN H. GOTTSHALL

**B**EAUTIFUL little pieces of pottery, vases, decorative metal work, and other fine things are accumulated in every home. No better place to display them could be found than this tall graceful Colonial cabinet. It will brighten up the corner of any room. For so fine a piece of furniture, the construction is relatively simple. The original cabinet was built of red gumwood, finished in Vandyke brown, but any cabinet wood may be used.

First cut the sides to length, dress and shape the ends, and sand them. One edge of the wider side must be rabbeted, so that both sides may be fitted and nailed together to form a 90-deg. angle.

The shelves now should be cut as in Figs. 4 and 7 from a board  $\frac{3}{4}$  by  $8\frac{1}{2}$  in. The grain should run as indicated in Fig. 4. The writer prefers free-hand curves for the fronts of these, but compass curves could be substituted. The beading should then be cut along the front edges of the shelves as in Fig. 6. If a shaper or an electric router is not available, these may be cut with a carver's V-tool. The fluting on the vertical strips, at the edges of the cabinet may likewise be cut with a carver's gouge of the correct size.

When the six shelves have been nailed into place, lay out the top edge of the pediment (Fig. 3) with a cardboard pattern on a piece of stock 2 by 8 by 15 in. This may be cut to the correct contour with a chisel, as the piece is almost too wide to be cut on the band saw; nevertheless, if a sharp saw

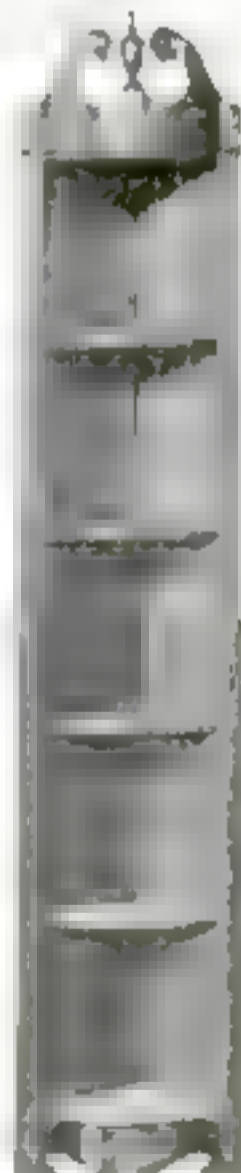
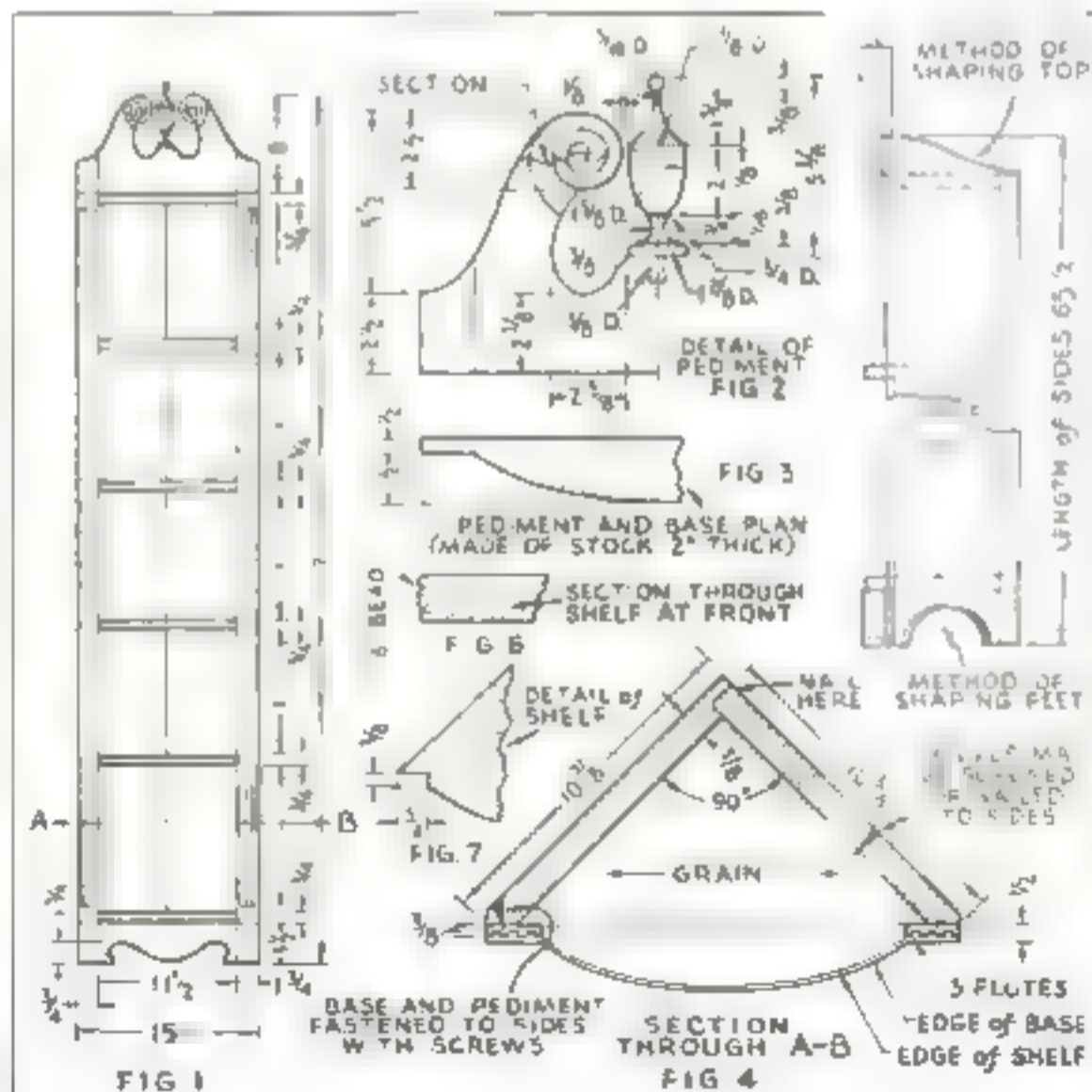
blade is used, it can be done. Next lay out the shape shown in Fig. 2, turning the pattern over to get the other half, and saw it out. To carve the Ionic scroll, first cut around the lines with a carver's V-tool, then finish by shaping with a carver's flat gouge, as shown in the cross section detail of Fig. 2. Proceed in a similar manner to shape the ornamental base.

The base should be fastened to the sides with screws from the back as indicated in Fig. 4. Next fasten the fluted strips, and finally the pediment. The final, which is turned in the form of a classic urn, is fastened by means of the small dowel turned on its base.

On the piece shown, the finish consisted of Vandyke brown oil stain, followed by a wash coat of shellac and two coats of a high-grade floor varnish. The final coat was rubbed with pumice stone and oil to give a smooth, velvety finish.



The original piece was made of red gumwood, stained Vandyke brown and varnished. At left are the complete assembly drawings with all essential details.



The original piece was made of red gumwood, stained Vandyke brown and varnished. At left are the complete assembly drawings with all essential details.

# Preparing Guns *and* Spars



By Capt. E. Armitage McCann

**W**E ARE now ready to equip our privateer model *Swallow* with guns. Those who have not started to build this model but wish to do so should read the previous articles in this series (P.S.M., Nov. '34, p. 65, and Dec., p. 71).

The bulwarks are pierced for ten guns, but it was a common custom not to carry the full equipment. I have given my model only six of the six-pounders and one long twenty-four-pounder, carried amidships. You may, of course, give her the full complement.

The shape and size of these guns are shown in the detail drawings near the end of this article, and the positions are given on the previously published deck plan. They are best turned from brass, but may be turned or filed from wood, or cast in brass or lead. Brass guns should be oxidized; if of other materials, they should be painted black.

Six-pounders were from 6 to 8 1/2 ft. long. I made mine to scale 7 ft. in length with

a caliber (size of shot) of 3.7 in. Twenty-four-pounders were from 9 to 9 1/2 ft. long, with a caliber of 5.8 in. The thickness at the breech is about three times the caliber and at the muzzle, twice the caliber. The trunnions (crossbars) are placed at a point four-sevenths of the length from the muzzle.

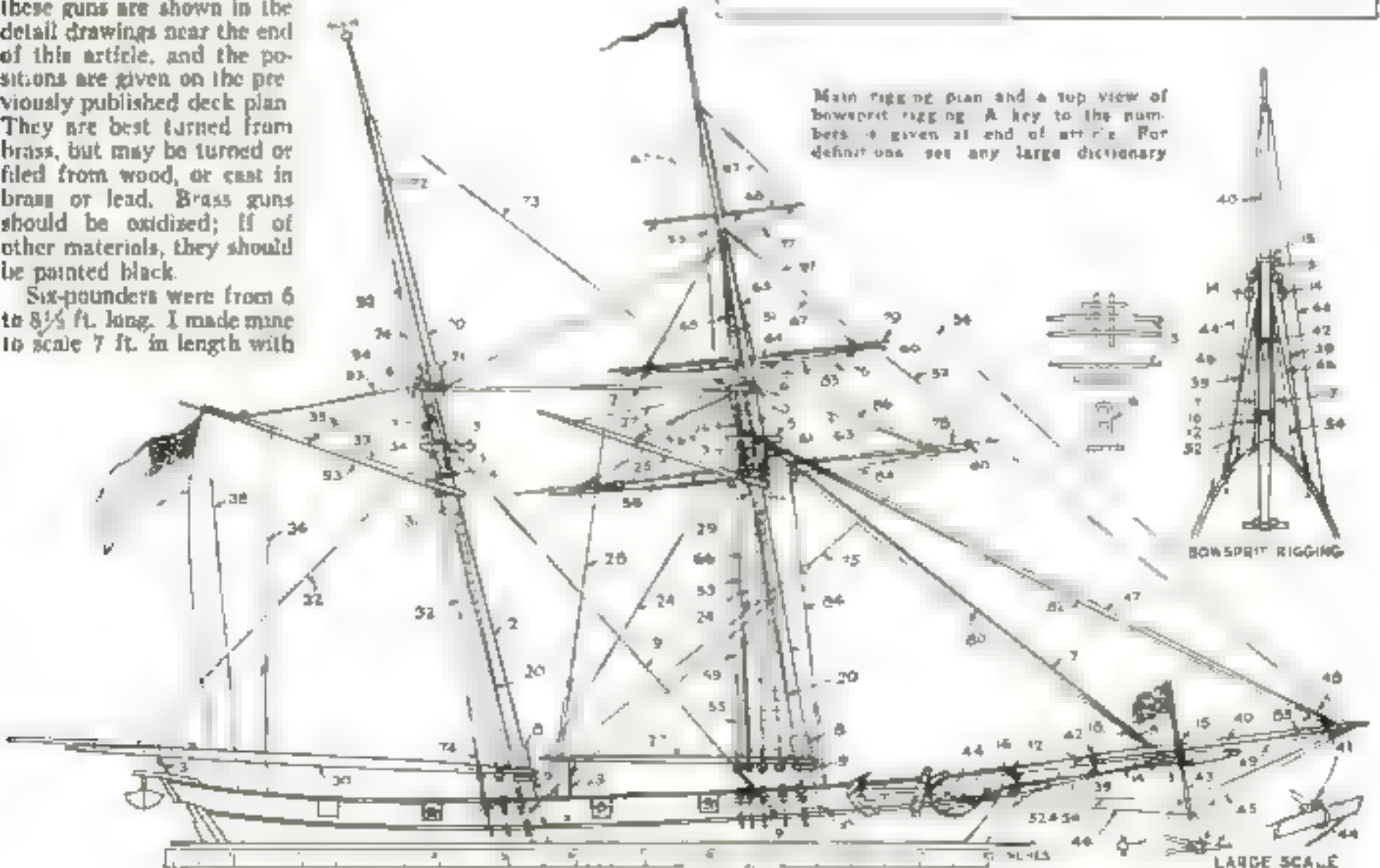
The carriages are four pieces of wood glued together, with the wheels on wooden axles that go under the carriages. The front wheels are slightly larger to compensate for the camber of the deck. The wedge at the back is to lift the breech. The guns, when level, should point through about the middle of the gun port. Notches are filed for the trunnions, and the guns are held down with bent-pin staples, except the large gun, which should have a piece of metal nailed over for this purpose. Eye-bolts are needed on the back steps for the tackles, and a ringbolt in the middle (at least on the large gun). They are all black. Simpler carriages may be made from an oblong stick with a groove in it to take the gun; and instead of wheels, round sticks may be used.

The guns are pulled up to the bulwarks with a tackle of two single blocks on each side. The blocks are strapped with wire hooks to go to the rings in the carriage and in the waterway. The ends are hitched around all parts. The breechings to take

## Ahoy, ship model makers! How Much Do You Know about RIGGING?

Here's a game to test your knowledge. You can try it whether you are building the *Swallow* or not. Look at the accompanying rigging plans, note the numbers, and see how many of the parts you can identify correctly by name. When you have made your list, compare it with the one on page 68. If you have as many as thirty correct, your knowledge of nautical terms is far above the average; if more than fifty, your mark is excellent; if more than seventy, you are an expert.

Main rigging plan and a top view of bowsprit rigging. A key to the numbers is given at end of article. For definitions see any large dictionary.





# Laying Out a Workshop

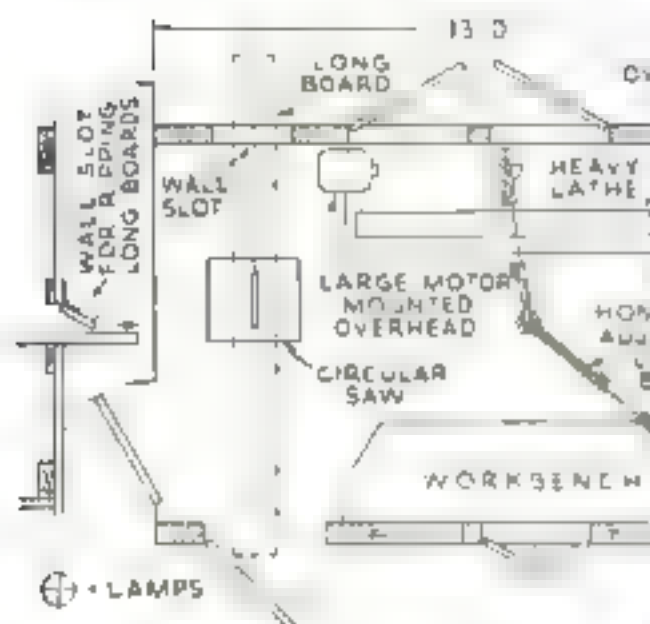


Fig. 1 Plan showing arrangement of equipment in a shop built as an extension to a garage. The exterior may be seen in Fig. 2



**I**F YOU are planning to install motor-driven machines in your home workshop, you will find it helpful to study the three practical and inexpensive layouts illustrated in the accompanying diagrams. They will give you an idea of how the other fellow goes about it. These plans supplement the suggestions contained in four previous articles in this series (P.S.M., Aug. '34, p. 83, Sept., p. 74, Nov., p. 90, and Dec., p. 92).

The shop shown in Figs. 1 and 2 was built by D. D. Galbraith, a carpenter of Pasadena, Cal., as an addition to the rear of his garage. He uses it to store and other materials salvaged from various jobs. This imposed certain limitations but enabled him to keep the cost very low. The addition houses several machines for which there was no room in the garage itself—a large lathe, a 12-in. circular saw, and a grinder—as well as a well-lighted workbench. The large motors that drive the machines are mounted on the wall above and back of the equipment, partly to give more space and partly to allow the use of longer belts, with their greater efficiency. The circular saw is placed in line with the door, and a wall slot makes it possible to rip long stock. Adjustable lamp brackets made of wood can be shifted so as to throw a good light wherever needed. The space above the ceiling and under the roof serves as a lumber rack. To give access to this storage place, the entire gable end is left open—a novel arrangement made possible by the equable climate.

In Fig. 3 is shown the plan of a shop set up in a corner of a double garage. The arrangement of machines is unusually compact, but daylight illumination is inadequate. A combination of individual drive and countershaft is used.

Another shop in a double garage is shown in Fig. 4. The machines in this case are installed on a long bench and driven by a single motor.

Except for the heating problem in the colder sections of the country a double garage offers excellent opportunities for installing a shop.—H. S. SIMLEY



Fig. 3 A shop is set out in the unused space of a double garage. The lighting will be improved when windows are cut above the tool rack and reference provided for the lamps. The plan is given at right

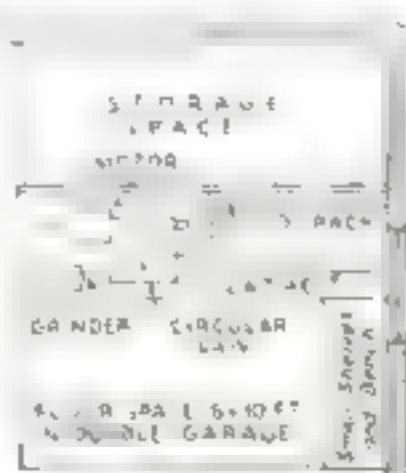
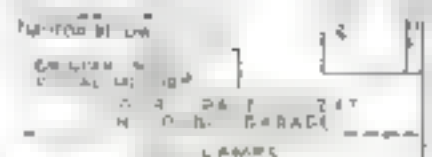
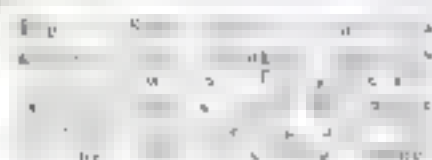


Fig. 4 Another plan for a room and satisfactory shop in the corner of a double garage. One motor drives the machines, all on a single belt



## GRADUATES HELD IN RACK UNDER SHELF



Glass graduates used in chemical experiments, in mixing photographic solutions, and for similar purposes can be kept handy without waste of shelf room by sliding them into racks made as shown. Rabbed strips of wood are fastened on the underside of a shelf in such a way that the foot of each graduate can be slipped in, as if on a track. In this way the graduates are securely suspended.

# BUILD A LITTLE FLEET ALL YOUR OWN WITH OUR Construction Kits

THE new fashion in ship model making is to build a set of miniature models all to the same scale. They make a fascinating display and usually attract more attention than a single elaborate model. Furthermore, each individual model in the set is quite simple and easy to construct, and a whole fleet can be built in a comparatively short time.

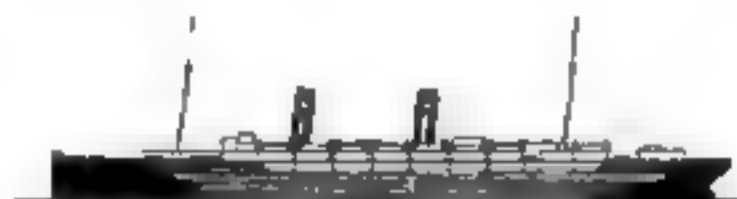
The ideal models for this purpose are those designed for the Popular Science Model-of-the-Month Club. There are now seven in the set, all famous American ships of different periods and types—*Atlantic*, *Savannah*, *St. Louis*, *Brooklyn*, typical World War destroyer, *Saratoga*, and *Tuscaloosa*. Others will be added from month to month.

These are the simplest of all our models. They are beautiful little water-line ships made mainly of balsa wood. A unique layer-built method of construction is used, so that they can be put together with no other tools than a pocketknife, some razor blades, a pair of pliers, and a few small nails.

In spite of the fact that they have been greatly simplified, these models are accurate in all essential respects. They have been prepared after much research from plans of the real ships by Theodore Gommel, a shipping expert who has collected data on famous vessels and built miniature models of them for years. What makes the models far more interesting, too, is the fact that they are all built to the same scale—1 in. equals 50 ft. They should not be confused with the many cheap and, for the most part, inaccurate models offered in toy construction kits.

The kits contain all the raw materials, paints, blueprints, and instructions. The prices are 75 cents and \$1, as shown in the following list.

In addition to the historic models, there is one project in the Model-of-the-Month Club series that was added for its current interest. That is the cup-winning yacht *Rainbow*. It is, of course, built on a larger scale.



KIT Q—An 11-in. model of the U. S. *St. Louis*



U. S. *Atlantic*



U. S. *Savannah*

Three famous ships. The two small ones are in one kit

If you wish to try something a little more elaborate—models that include the underwater part of the hull—you have a choice of three, listed under the heading of "simplified ship model kits." In these kits the hulls are furnished roughly shaped, and various finished and semifinished parts are included.

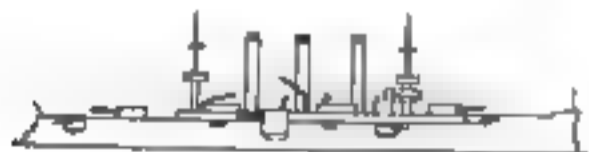
For those who wish larger models, there are our standard kits. Although not particularly hard to construct, the models themselves are of a very fine type and some of them are worth several hundred dollars each if carefully built. There is ample choice for everyone—the famous *Hartford*, the modern battleship *Texas*, two galleons, one Spanish and the other English, a wonderful old whaler, and the rakish Baltimore Clipper *Saratoga*.

In addition, we have a few specially designed furniture kits. All the machine work has been done, and the parts can be put together after a little hand finishing and fitting. These are distinctive custom-built designs and of superior quality throughout.

## STANDARD SHIP MODEL KITS

- A. Whaling Ship *Hanover*, 20 3/4-in. \$6.00\*
- AA. Same with hull lifts sawed 40\*
- D. Spanish galleon, 24 in. 6.45\*
- DD. Same with hull blocks shaped 6.95\*
- E. Battleship U. S. *Texas*, 34 in. 6.95\*
- EE. Same with hull lifts sawed 45\*
- O. Elizabethan galleon *Revenge*, 25-in. 6.75\*
- OO. Same with hull blocks shaped 7.25\*
- L. Farragut's flagship *Hartford*, a steam

Here is a remarkable fleet of outstanding American fighting ships all built to the scale of 1 in. equals 50 ft. The model of the aircraft carrier *Saratoga* is 18 in. long.



KIT T—U. S. *Brooklyn*



KIT R—*Tuscaloosa*



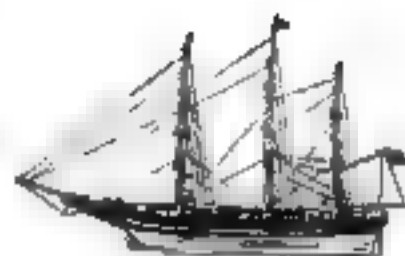
KIT N—Destroyer



KIT M—*Saratoga*

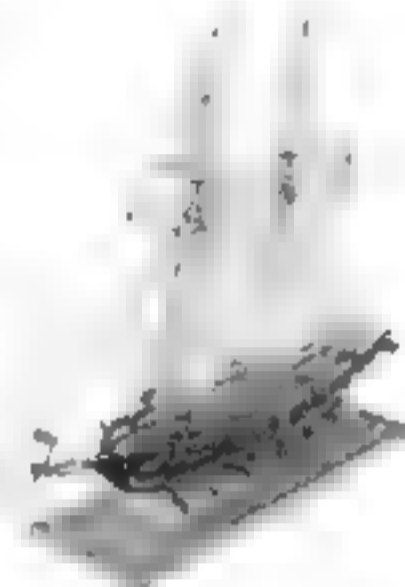


KIT NO. 2



KIT J—*Sea Witch*

KIT Q  
*Swallow*



This is Captain McCann's latest model

- and sail sloop-of-war 13 1/2-in. hull..... 7.95\*
- LL. Same with hull lifts sawed..... 8.45\*
- Q. Privateer *Swallow*, 12 1/4-in. hull, with lifts sawed to shape..... 4.95\*

## MODEL-OF-THE-MONTH KITS

- M. Aircraft carrier *Saratoga*, 18-in. 1.00
- N. Four U. S. destroyers, each 8 1/4-in. .75
- O. Liner U. S. *St. Louis*, 11-in. 1.00
- II. Cup yacht *Rainbow*, 7 1/2-in. .75
- R. U. S. cruiser *Tuscaloosa*, 11 1/2-in. 1.00
- S. U. S. *Savannah* (three steamship to cross Atlantic) 3 1/2-in. and U. S. *Atlantic*, 6 in. (two models in one kit)..... .75
- T. U. S. *Brooklyn*, armored cruiser in Spanish American War, 8-in. .75

## SIMPLIFIED SHIP MODEL KITS

- F. Liner U. S. *Manhattan*, 12-in. 1.00
- H. Cruiser U. S. *Indianapolis*, 12-in. 1.50
- J. Clipper ship *Sea Witch*, 13-in. 1.50

## FURNITURE KITS

- No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble, but without finishes..... 3.40\*
- No. 4. Solid mahogany book trough 27 1/2 in. long, 9 1/2 in. wide, and 24 1/2 in. high over a ready to assemble, with finishes..... 5.30\*
- No. 5. Solid rock maple hanging wall rack with one drawer, 19 1/2 in. wide, 33 1/2 in. high. Ready to assemble and stain included..... 3.75\*
- No. 6. Solid rock maple butterfly table, top 19 to 22 in., height 27 1/2 in. Ready to assemble and stain included..... 6.90\*

Note: If you live west of the Mississippi River add 50 cents to all prices marked with an asterisk (\*) because of the heavy shipping charges. Otherwise all prices are low and anywhere in the United States. The kits marked with an asterisk will be sent C. O. D. if requested, but the purchaser will have to pay 25 cents additional upon delivery.

Popular Science Monthly,  
151 Fourth Avenue, New York, N. Y.

Please send me Kit \_\_\_\_\_ for  
which I enclose \$\_\_\_\_ (or send C. O. D. ☐)

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

(Print name very clearly)

Please remember that no kits can be sent C. O. D. except as noted above. This offer is made only in the United States.

# STEP-BY-STEP INSTRUCTIONS FOR Making SKIS



Skating is an acrobatic sport of the most exhilarating type



The points are softened with boiling water

By  
**LEONARD F. MERRILL**  
*Famous Maine Guide*

A PAIR of skis will afford one hour of pleasure and the cost is neither difficult nor expensive.

**Materials:** Two pieces of spruce, or beech  $\frac{3}{4}$  by 4 by 10 in., two of strap leather, one  $\frac{3}{4}$  in. wide and 2 ft. long and the other  $1\frac{1}{2}$  in. wide and a 2 ft. long, two  $1\frac{1}{2}$ -in. loop bar buckles,  $\frac{3}{4}$ -in. loop bar buckles, one 9-ft. pole; a few strips of rawhide twine; 6 ft. of  $\frac{1}{4}$ -in. iron wire; a hammer to make the bending board, and a plane for foot plates.

The exact width and length of the skis is governed by the height of the user. The width ranges from  $1\frac{1}{2}$  to 4 in., and the length is the height to which he can reach when standing. The skis described are for one who can reach about 6 ft.

**Tools.** A plane, spokeshave, marking gauge, No. 3 or 4 bit, narrow chisel, awl and waxed thread, rule, try-square, knife, and  $\frac{1}{8}$  in. gouge.

**Shaping.** Square up one edge and one end. Gauge to width and measure to length. Select better side for bottom and gouge a groove  $\frac{1}{2}$  in. wide and  $\frac{1}{4}$  in. deep from a point  $8\frac{1}{2}$  in. from one end down the middle to the other end.

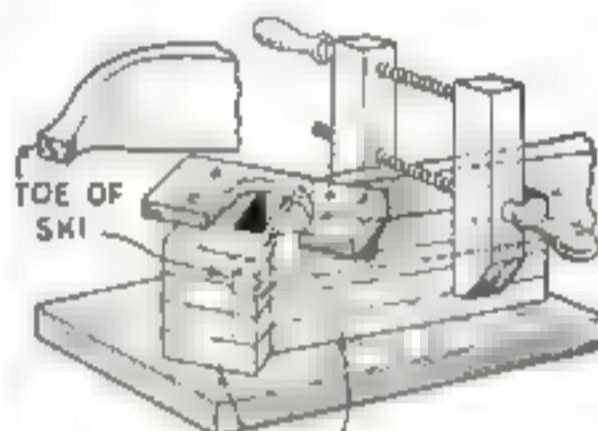
At the  $8\frac{1}{2}$ -in. point the ski is the full  $3\frac{1}{4}$



in. width and tapers from there to both ends. The toe end comes in with a curve, leaving a  $\frac{1}{2}$ -in. tongue at the very tip. The heel taper is straight to  $3\frac{1}{4}$  in. at the end.

Before cutting the sides of the ski, lay out and cut a through mortise for the toe strap as shown. The actual size of the mortise is governed by the size of the strap used. Then cut the sides to the lines.

The bottom of the ski is left perfectly



BENDING BLOCKS SECURELY NAILED TO BASEBOARD

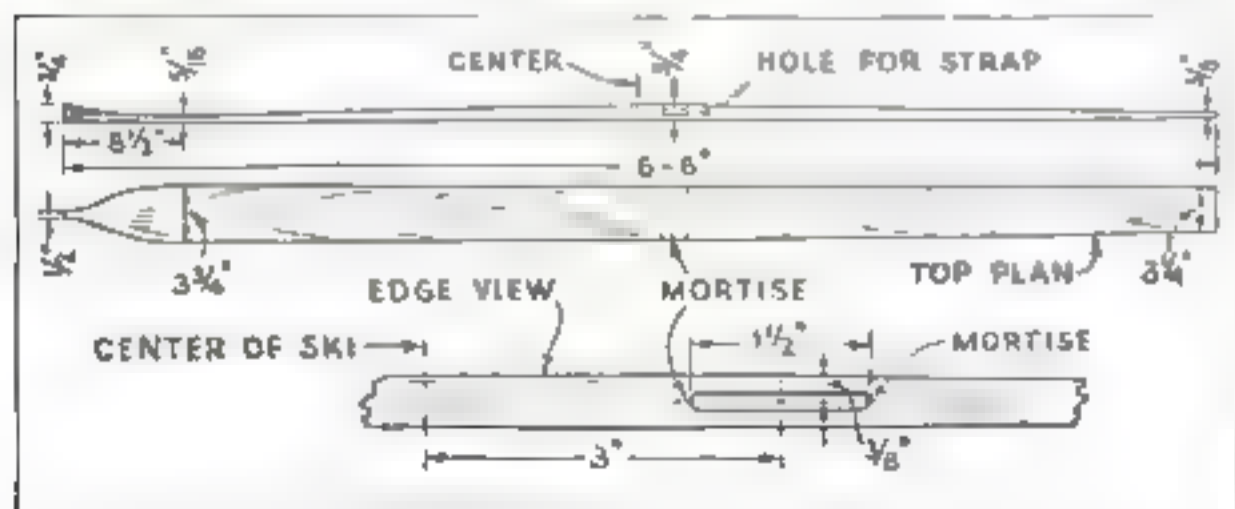


Method of making and using the bending form

straight, but the top is cut down. At the heel end it is  $\frac{1}{4}$  in. thick; at the  $8\frac{1}{2}$ -in. point,  $\frac{5}{16}$  in.; at the extreme toe,  $\frac{1}{4}$  in. The taper from the toe to the  $8\frac{1}{2}$ -in. point is curved to allow for a smooth bend, but from there to the middle and from the middle to the heel it is straight.

Sand the entire ski to a smooth, clear surface. At this point a marking gauge may be used to groove the upper side in a neat three- or four-line design. Merely remove the point of the gauge, grind it down to a fairly blunt round point, and replace it.

**Bending.** Build up a block about 4 by 4 in. square and from (Continued on page 91)



A layout for skis designed for a man who can reach about 6 ft. high and a larger edge view of the central part, showing the mortise or hole made for the wide toe strap of the harness



A professional finish is given the skis by scratching in lines with a blunt gauge

# Final Rules Announced for the \$2,000 NATIONAL HOMEWORKSHOP GUILD CONTEST



The first Popular Science silver medal to be awarded was won by C. J. Boeger of the Topeka Club for this picture frame.



Official Magazine  
Published Monthly

The silver cup shown above will be awarded for the best example of model making entered in the National Guild Contest. A cash prize of \$100 will accompany it. There will be nine other silver trophies. The group of amateur craftsmen at the left are members of the B. & L. Home Workshop Club, Billings, Mont.

**C**OMplete rules and regulations have now been formulated for the coming National Homeworkshop Guild Exhibition and Contest. It will be held in Chicago, March 25 to 30, 1935. As previously announced (P. S. M., Oct. '34, p. 72), there will be thirty-eight prizes amounting to \$2,000 in cash and including ten silver cups and trophies. The awards will be made at a Guild banquet to be held before the close of the exhibition.

The current Guild Bulletin, which goes to each of the 119 local clubs now chartered by the Guild, contains the rules in detail. A summary is given here because so many readers who are not yet affiliated with the Guild have written to ask under what conditions they may compete. The principal condition, of course, is that they must be members of a club affiliated with the Guild. Since any five or more men interested in craftwork may organize a club and apply for a charter, this is a condition easily met. The fact that the Guild is strictly noncommercial and the dues are nominal makes the work of starting a new club still easier. Prompt action is necessary, however, in order that new clubs may get their charters and affiliate cards in good time to enter the contest.

See the coupon at the end of this article.

The contest rules are, briefly, as follows:

1. All entries must be the work of clubs affiliated with the Guild or their members, and all projects must have been started since January 1, 1934.

2. Each project must be entered in only one classification. (These classifications were published in the October 1934 issue.)

**Awards will be made  
at great craftwork  
exhibition in Chicago  
next March . . . Local  
clubs to name national  
exhibition delegates  
. . . Scope of show  
is expanding rapidly**

3. All work submitted must have been built or assembled by the contestant, but the design does not necessarily have to be original.

4. Projects that have been displayed at local club exhibitions are eligible.

5. Each entry must be accompanied by an official entry blank.

6. No entry fee will be charged.

7. Exhibits must reach Chicago not earlier than March 15, 1935, and not later than March 25, 1935. Suitable labels will be supplied.

8. Entries in Division 2, Civic Activities of Clubs, will consist of a loose-leaf notebook, scrapbook, album, portfolio, or other suitable binder containing the following: (a) A statement of what the club has accomplished in the way of civic or community activities. (b) Newspaper clippings (if available) showing the public recognition given to such work. (c) Any available photographs showing projects made for community use or illustrating the participation of the club in civic activities. (d) Copies of letters from officials of the community or other organizations relating to the civic activities of the club. (e) Any further evidence of such activities as the club may wish to present.

9. The Grand Sweepstake Prize,



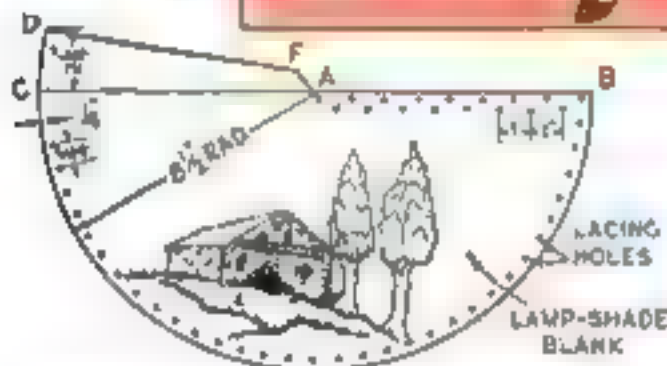
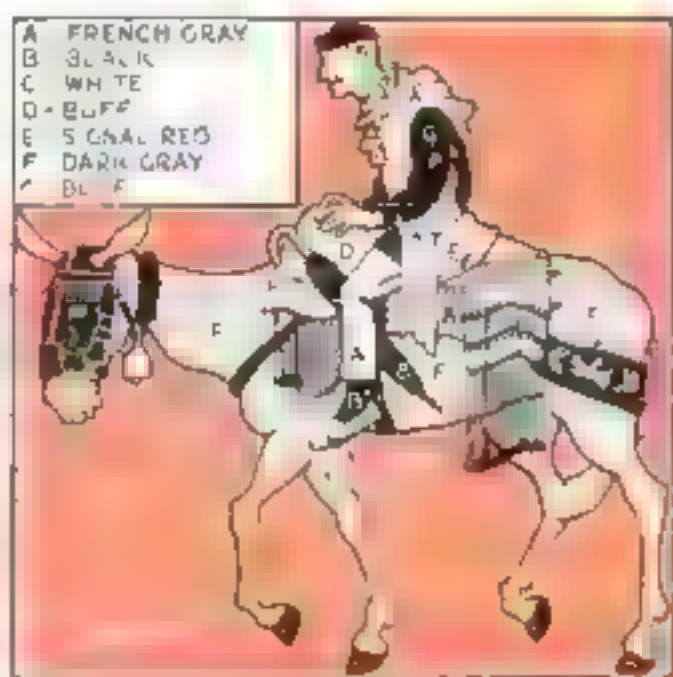
# Peasant on Muleback

## Ornaments Unique Little Table Lamp

By  
**Luis Gurrea**

MADRID, SPAIN

How to lay out the figure and a suggested color scheme and, extreme right, the lamp base and lamp-post



A pattern for the shade with an appropriate landscape design, which is painted on in brown tones

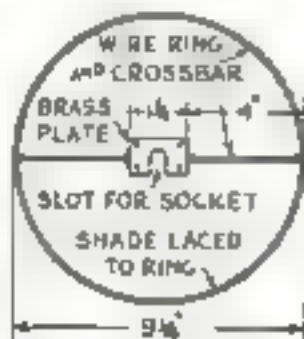
**T**HIS original table lamp represents a Basque peasant riding a mule to market. Its construction is well within the ability of any woodcrafter.

Draw the design full size and transfer it with carbon paper to a block of wood  $\frac{3}{4}$  by 7 by 7 in., the grain of the wood running up and down the figure. Any soft carving wood will do. Cut the profile out with a jig saw or coping saw and trim with a sharp jackknife or chisel. Round the edges of the figure and mark the outline of the man's legs, umbrella, saddle, blanket, and harness. This is done with vertical cuts and worked out with slanting cuts toward the vertical cuts.

With the gouges marker, proceed to carve the figure. The man's legs and shoe are left in high relief. The harness is raised only a little above the body of the mule. The mule's head is reduced to about  $\frac{5}{8}$  in. thick, and the harness, eyes, and mouth left just a little in relief. The neck at the point nearest the head is reduced to  $\frac{1}{2}$  in. thick and is tapered to the body. The head of the man is about  $\frac{3}{8}$  in. thick. He has a handkerchief and a string of garlics around his neck.

The front and hind legs of the mule on the right side are next cut down to a depth of  $\frac{7}{16}$  in. and the left legs are similarly carved, but from the opposite side. This work should be done with razor-sharp tools. Round the edges of the legs with the exception of the joints and hoofs.

Give the pommel or front of the saddle a conical shape, round on top, and have its lower edge about  $\frac{1}{32}$



How the lamp-shade support is assembled

in higher than the body of the mule itself. The left ear is cut down to about  $\frac{1}{16}$  in. likewise the right ear, but from the opposite side. Round the edges of the ears very carefully.

The other side of the design is exactly the same, but without the umbrella. (For helpful instructions in wood carving, see P.S.M. Apr. 1933, p. 71.)

The base of the lamp is turned from a block  $1\frac{1}{2}$  to 2 in. thick. A hole is made in the center  $\frac{3}{4}$  in. in diameter and  $\frac{1}{2}$  to  $\frac{3}{4}$  in. deep. If a lathe is not available, the base can be made square or hexagonal with an appropriate molding.

The lamp-post is made from two pieces  $\frac{1}{2}$  by  $\frac{1}{2}$  by 10 in. These are glued together with a piece of paper between, and the design is drawn and cut out. Then the two parts are separated, and a groove  $\frac{3}{8}$  in. deep and  $\frac{1}{4}$  in. wide is cut in the middle inside face of both sides, following the zigzag shape. The lamp cord is inserted and the two parts are glued together. The lamp-post and base are then assembled with glue. The lower end of the wire, of course, should pass through the base,

for which purpose a groove must be made underneath. Glue the wire in place and cover it with a plastic wood composition. The lamp stand is lacquered sky blue, signal red, navy green, or any desired color.

The left side of the figure is then painted with all colors according to the color chart. Once the paint is dry and before going any further attach the figure to the lamp-post with a screw. Countersink the screw, cover it with plastic wood composition, sandpaper smooth, and proceed with the painting.

With tinned stiff wire about  $\frac{1}{2}$  to  $\frac{3}{4}$  in. in diameter make a hoop  $9\frac{1}{4}$  in. in diameter and two crosspieces, each 4 in. long. Solder as shown with a brass or tin plate at the center. This is nailed to the lamp post to hold the shade.

On a piece of lamp-shade paper, draw a semicircle with an  $8\frac{1}{2}$ -in. radius and joining the circumference on one side about  $2\frac{1}{4}$  in. Paint the design with burnt umber oil paint. Punch  $\frac{5}{32}$ -in. holes all around the circumference, spaced  $\frac{1}{4}$  in. apart and  $\frac{1}{4}$  in. from the edge. The double row of holes going from the vertex to the base of the shade are 1 in. apart and the rows are  $\frac{3}{8}$  in. apart, with the holes in one row  $\frac{1}{2}$  in. higher than those in the other row. When forming the cone, line AB should coincide with line AC, therefore the holes in part on ACDF should be made to coincide with those on the other side. With lacing of leather or imitation leather, join the shade from the vertex down to the base and continue around the border.



This easily constructed lamp has a decorative quality that places it in a class by itself



GET YOUR  
COPY OF THE

## 1934 Home Workshop INDEX

**O**UR Home Workshop Annual Index for 1934 is now ready. To obtain a copy, it is not necessary to fill out a coupon or write a letter. Merely address Popular Science Home Workshop Index, 381 Fourth Avenue, New York, N. Y., and enclose ten cents together with a plain return envelope addressed to yourself. Do not put a stamp on the return envelope which you inclose; we will pay the postage when we mail the Index to you.

The Index is a complete alphabetical list of all the articles published in Popular Science Monthly during 1934 in reference to woodworking, craftwork, shop methods, house repairs and short cuts, boats, model making, radio, automobiles, electrical apparatus, and such hobbies as photography, chemistry, microscopy, and astronomy. Provided you have kept the issues of 1934, the Index is the one thing needed to enable you to find what you want when you want it. Without the Index, that is a difficult task, because there are almost 400 pages of this type of information in one year's magazine—a gold mine of permanently useful material.

# MONTH'S BEST AUTO IDEAS



## Mirror Hung in Garage Is Handy in Many Ways

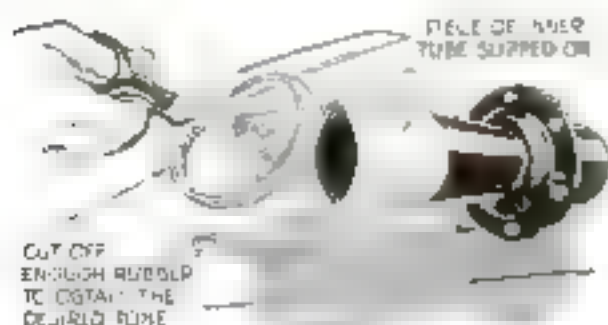
**I**N MY garage I have a large mirror salvaged from the attic and hung on the rear wall. When I drive in or out it helps me to keep the car in the center away from the walls. At night, it gives me a quick check on my headlights, and when I work on the light wiring, it does

away with the necessity of running around to the front of the car every time I try to make a faulty headlight work. The mirror is the handiest addition I have made to my garage in recent years. I am always finding new uses for it in working on the car by night or day.—J. C.



## Breaker Point Dresser

**R**ECENTLY when my car failed to start and inspection showed that the breaker points needed cleaning. I found that my tool kit lacked a thin file as well as emery cloth. When I was about to give up, I spied a safety-match box on my bench. Folding the box flat to expose the abrasive strip, I went to work on the points. In a few minutes I had done a professional cleaning job and my car started without further trouble.—C. E. P.



## Lifting Heavy Wheels

**L**IFTING a wheel into place on a jacked-up axle is not always an easy task, especially if the tire is heavy. However, if you have a modern screw jack, you can use its folding handle as a lever to lighten the work. Simply open the joint a few inches, place the opened ends under the tire, and lift up. You'll be surprised how

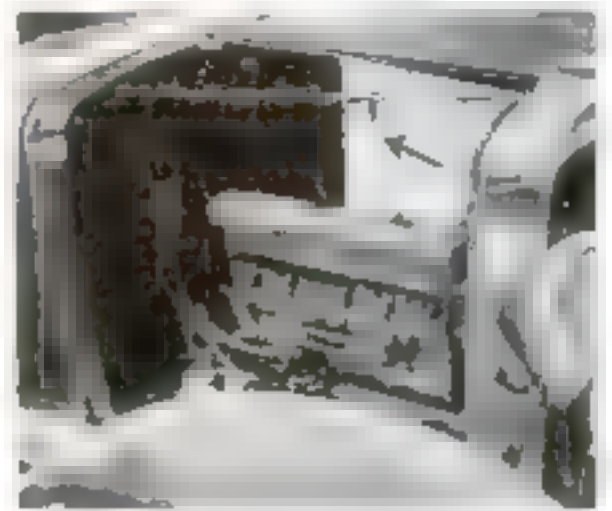
easily the wheel will slip into place. The drawing below shows how the handle is placed.—W. C.



## Changing Horn's Tone

**C**AR owners who dislike the sound of their car's horn can change its tone by slipping a length of inner tubing over the end. It is best to start with a section about a foot long, clipping off an inch at a time, as shown at left, until just the right note is obtained. The tube lengthens the sounding horn.—H. A.

*Ingenious Methods Found by Our Readers to Solve Common Problems in Cars*



## Built-In Trouble Light

**A** HANDY trouble light can be made from a spare headlight lamp, any bayonet-type socket, a few feet of wire, and an ordinary battery clip. First, connect two short lengths of wire to the socket. Bore one wire for two or three inches and to the other fasten the spring clip. Then wrap the bare wire around one radiator stay to serve as a ground, hang the socket on the same stay, and screw in a bulb to complete the job. To use the light, simply snap the battery clip onto the terminal at the top of the starter motor to complete the circuit. This eliminates the clumsy length of wire that forms a part of most trouble lights, and the trouble of mounting a socket and switch on the cowl wall.—R. W.

## Fixing A Noisy Muffler

**W**HEN a muffler suddenly becomes noisy, nine times out of ten it is due to open seams in the casing caused by vibration or a backfire. Generally, it can be quieted by sealing the leaky seams with ordinary asbestos furnace cement. Mix the cement to a paste and spread it on making sure that it sinks into the openings. The open seams can be found easily by their soot-blackened appearance. Since it resists heat, the cement will not be loosened by the exhaust fumes.—C. A. I.



Asbestos furnace cement spread on the seams of a noisy muffler will silence it effectively.



**TIRED OUT?**

**ACROSS HIS DESK** flows the news of the world: Ray Baker of International News Service. Telegraph wires . . . cables from foreign countries . . . flash 100,000 words a day to Baker . . . to be quickly judged and edited.



**GET A LIFT  
WITH A CAMEL**

Copyright, 1933, R. J. REYNOLDS TOBACCO COMPANY

## PERSONAL EXPERIENCES THAT POINT THE WAY TO INCREASED ENERGY!

Newspaper man—hockey star—business woman—wherever smokers are placed in life, they notice a positive energy-refreshing effect from smoking Camels when they are tired or "out of sorts."

As Ray Baker says regarding his own experience: "The man on the INS news desk has a high-pressure job.

"Whenever I feel 'all in' Camels bring back my pep, and I can tackle

the next story with renewed energy! For over ten years I've preferred Camels. They have a rich, distinctive flavor that just suits me. And I can smoke Camels continually without jangled nerves."

Science confirms the experience of smokers regarding Camel's "energizing effect." You can smoke them freely since Camel's matchless blend of costlier tobaccos never upsets the nerves!

## LEAF TOBACCO EXPERTS AGREE:

"Camels are made from finer, more expensive tobaccos—Turkish and Domestic—than any other popular brand."

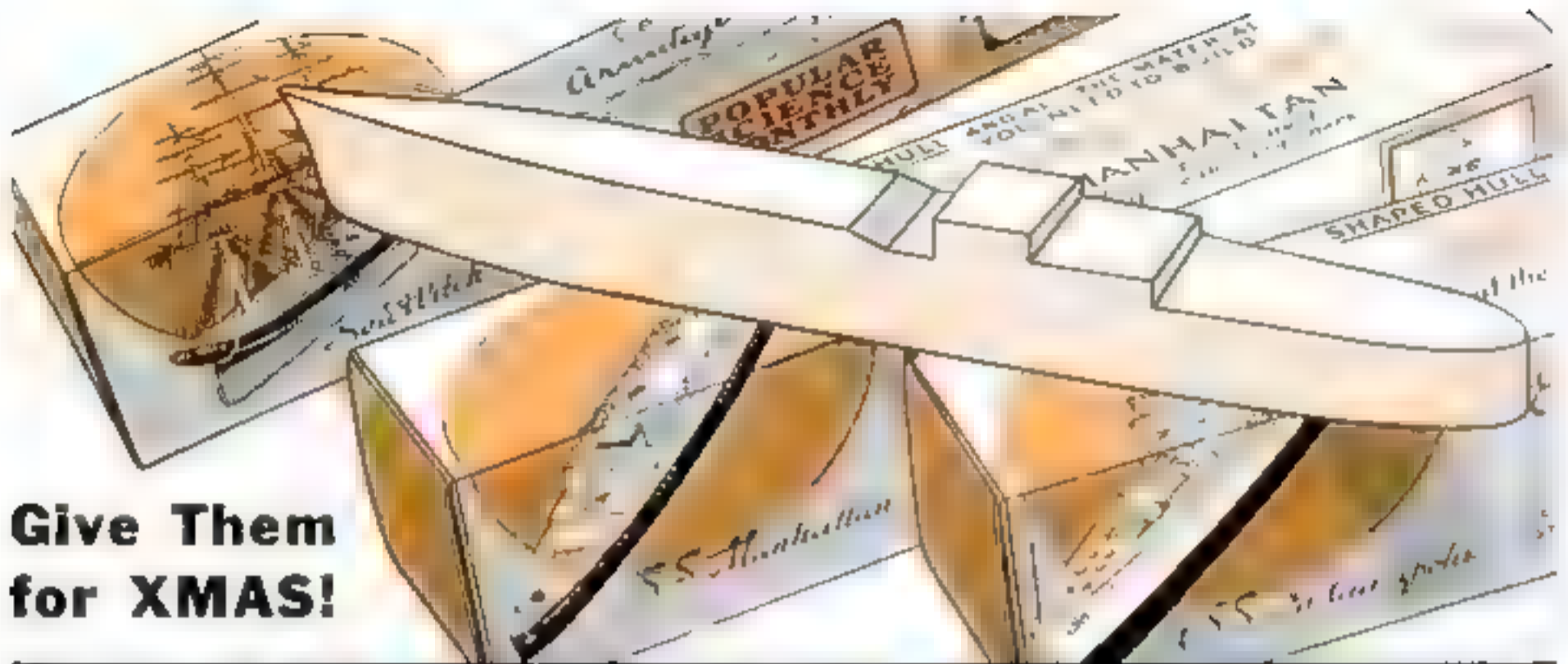


**HOCKEY STAR:** "Bill" Cook says: "I smoke only Camels. Their taste sure hits the spot! I smoke a lot and I find that Camels never get on my nerves or tire my taste."



**BUSINESS GIRL:** Eve L. Miller says "I started to smoke Camels because I appreciate mildness and delicacy of flavor, and Camels give me a 'lift' when my energy is low."

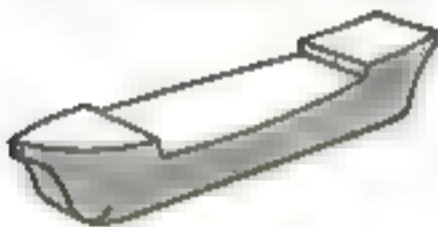
**Camel's costlier Tobaccos never get on your Nerves!**



**Give Them  
for XMAS!**

# BUILD YOUR OWN SHIP MODEL

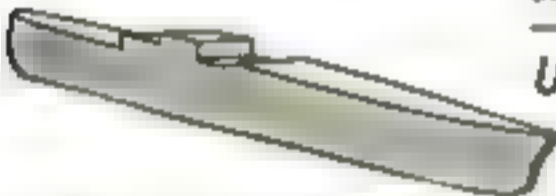
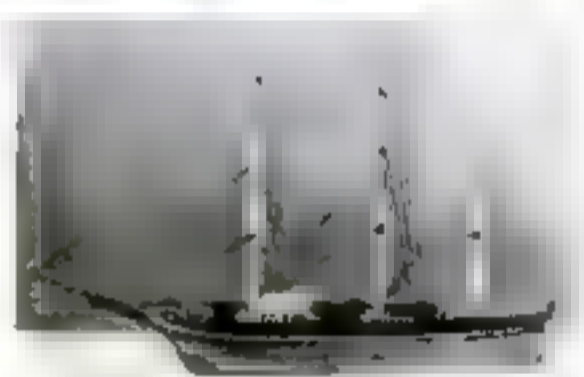
With These New, Improved, Simplified Shaped-Hull Kits



Sugar pine shaped hull—main cuts already made. Easy to finish. Top print shows location of masts, deck houses, etc.

## Clipper Ship "Sea Witch" \$1.50 Postpaid

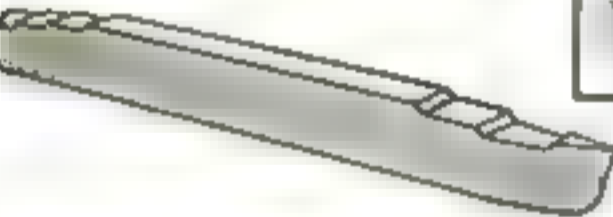
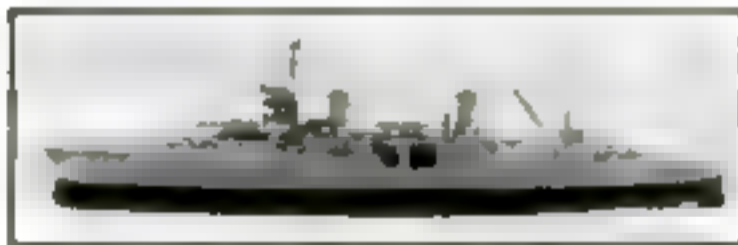
13 inches long—8 inches high. Famous and beautiful American Clipper. Kit contains every part needed including blue print, and pamphlet of instructions. Top deck of shaped hull stamped for location of masts, houses, etc. Kit contains paints, glue, chain, deadeyes, anchors, flags, printed bow and stern name plates. \$1.50 delivered.



Almost wholly shaped hull of soft sugar pine with all main cuts already made, easy to finish.

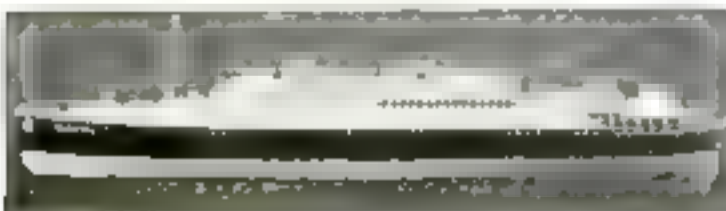
## U. S. S. Indianapolis - - - \$1.50 Postpaid

Complete Kit for 12 inch model of the famous cruiser from which Pres. Roosevelt viewed the fleet. An excellent, graceful, racy model, easy to make with simple hand tools. Kit contains everything needed including paints, glue, anchors, propellers, rudder, blue print, pamphlet of step-by-step instructions, etc. \$1.50 postpaid



## S. S. Manhattan - - - \$1.00 Postpaid

Everything you need to make a 12 inch model of this largest and finest American built liner. A sharp pocket knife is practically the only tool you need. Kit contains paints, glue, blue print pamphlet of instructions, 40 completely finished life-boat davits, 2 propellers, 2 anchors, 1 rudder. All main cuts in the sugar pine hull already made



**DEALERS!**  
Write for Terms on  
These Attractively  
Packaged New Kits

## Model Makers USE THIS COUPON

Fill out and mail this coupon together with remittance and the complete kit or kits you want will be shipped immediately delivery paid by us.

POPULAR SCIENCE MONTHLY,  
351 Fourth Avenue, New York, N. Y.

Send me \_\_\_\_\_

<input type="checkbox"/> SEA WITCH	\$1.50 Postpaid
<input type="checkbox"/> INDIANAPOLIS	1.50 Postpaid
<input type="checkbox"/> MANHATTAN	1.00 Postpaid

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ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

# Night Lamp in form of Lighthouse

FLASHES ON  
WHEN LIFTED



This is a good bedside lamp for emergency use because the act of lifting it automatically switches on the light.

By Herman Hjorth

A NOVEL automatic night light that flashes on when lifted may be made in the shape of a lighthouse model, as illustrated. The body and base are of wood and the design may be varied so that the flash light will be a miniature copy of any particular lighthouse with which the builder may be familiar.

Bore a 1 1/2-in. hole through the endwood of a 3 by 3 by 6 3/4 in. piece of whitewood or other softwood, using an expansive bit. Turn and fit plugs into each end, and turn the stock. The lower part must have a projection to fit into a corresponding recess in the base. Turn the base from a piece of wood 1 1/2 by 4 by 4 in.

The flash light bulb is fixed and soldered into a copper or brass disk, which must be firmly wedged in the 1 1/4-in. hole about 1/2 in. from its upper end. The lower end is provided with an automatic spring switch made from a piece of 5/8 in. or hard rubber and a piece of spring brass. A copper or brass disk, a little smaller in diameter, covers its upper surface and is riveted to the piece of spring brass. The switch is held in place by a copper or brass

ring screwed to the underside of the base. A wire or metal strip connects the upper copper disk and the copper ring, being soldered to both. A spring such as is used in ordinary flash lights presses the dry cells against the underside of the bulb and makes the connection between them and the spring switch. When the switch touches the copper ring upon lifting the lighthouse, the circuit is closed and the bulb lights.

The upper part consists of a capsule vial of glass 1 1/4 in. in diameter and 2 in. long, which can be obtained in most drug stores. The top is turned from a piece of wood 1 1/4 in. thick, 1 1/2 in. wide and 1 1/2 in. long, which is recessed to fit snugly over the inverted vial. Paint this recess and the copper disk white, and finish the exterior as desired with enamel or lacquer.

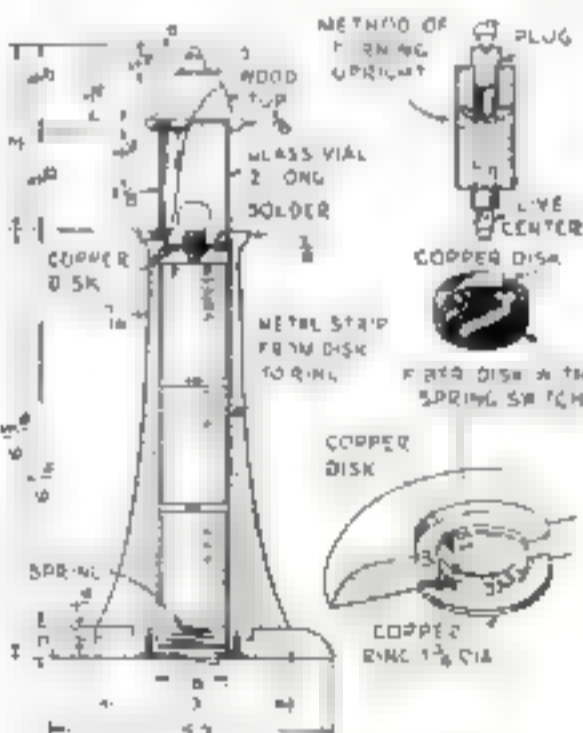
If a lathe is not available, the case of an old flash light may be used as the body of the lighthouse, and the base and top part may be modified to suit whatever materials are on hand, as described in a previous article on a similar type of night light (P. S. M., Oct. '32, p. 65).

## NOVEL GIFT SEWING KIT IN PELICAN DESIGN



IF YOU still have some last-minute gifts to make, here is a unique idea for a sewing kit. It is in the form of a pelican mounted on a turned wooden box. To save time, a suitable box may be purchased, or an ornamental turned block could be substituted. The bill of the pelican is formed by a pair of scissors, and its back is upholstered to serve as a pin-cushion.

The bird is cut with a coping saw or jig saw from three pieces of wood, the two outside ones being 3/4 by 5 1/4 by 5 1/4 in., and the center one, 1/4 by 4 1/4 by 5 1/4 in. The grain of the outer pieces should run up and down that of the middle piece, horizontally. The outline of the mid- (Continued on page 81)



A cross section of the lighthouse lamp, how the body is turned, and details of the switch.

## "pure hide" AND WHAT IT MEANS to the HOMECRAFTER

For years and years, America's finest furniture and automobile bodies have been built

with Keystone Pure Hide Glue. The strength is there to stay!



This same superior Pure Hide Glue is now available to all

Homecrafters in convenient packages and cans. Have the satisfaction of building a piece of furniture that you know will be as solid in twenty years as it is a month from now. See below.

## Special Offer



With each order for standard 25c. can (Liquid) or 25c. box (Dry) of Keystone Pure Hide Glue we will send you, post-paid, a FREE copy of the new GLUE HANDBOOK shown above, containing over 70 pages of valuable information concerning the History, Manufacture, and Correct Use of Glue.

In ordering, send stamps or money order, not cash.

**Keystone Glue Co.**  
MANUFACTURERS OF  
PURE HIDE GLUE EXCLUSIVELY  
WILLIAMSPORT, PA.

## SPEEDIER WAYS TO MAKE

# Photo Enlargements

By Frederick D. Ryder, Jr.



Homemade bromide paper holder fastened on a vertical enlarging easel with thumb tacks. The holder consists of a cardboard backpiece, a spacer and a masking frame.

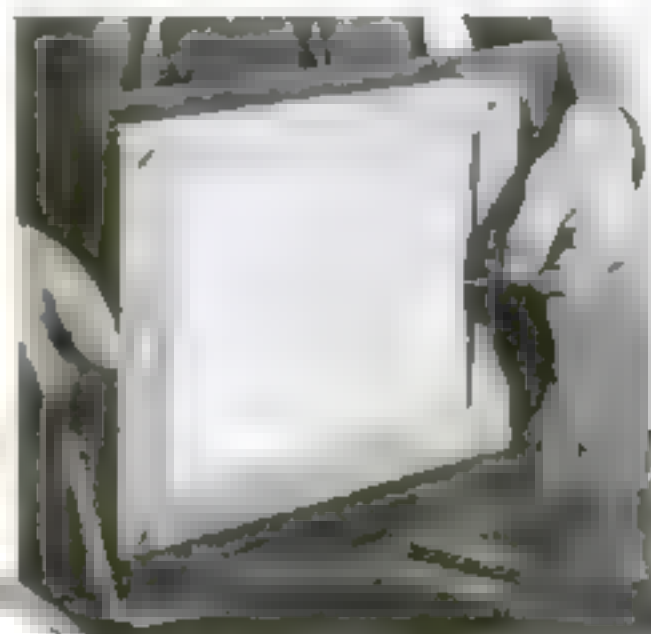
**I**F YOU figure out how you spend your time when you are making photographic enlargements, you will find that far too much of it is wasted in getting the paper properly masked and in the right position to include the portion of the negative you wish to enlarge.

Of course, when you set out to get the best possible enlargement from an especially good negative, you do not mind how long it takes to try different papers with all sorts of odd dimensions for the masking, but if you are like the average amateur photographer, what you want most is the simplest possible way to get large prints from your negatives without wast-



ing any more time than necessary. Furthermore, you probably prefer to make the majority of your enlargements to some definite size. For most purposes, two fixed-size paper holders are sufficient.

An ideal paper holder should keep the



A pin is used to push the paper over the waiting fingers of the other hand. At left: Centering a small negative with the aid of a mask of black and white paper.

paper flat, should be so arranged that the paper can quickly be slipped into place, should automatically mask off the edge to form a clean-cut, white margin, and should be easily held in place on either a horizontal or a vertical easel. Finally, it must be

convenient to move and turn to any angle.

In theory, the only way you can hold paper absolutely flat is to place it on a flat surface and cover it with a sheet of glass. In practice, the glass may be eliminated if the paper is held against a flat surface all around its edges. Our paper holder therefore must have a flat surface for a back and a rim to hold the four edges of the paper.

Factory-built adjustable paper holders are, of course, obtainable. A unit of this type will cost from seven to ten dollars depending on the style and make. These units are purposely made heavy so that they will stay in *(Continued on page 82)*

## \$50 for Christmas Photos

**N**O AMATEUR photographer has far to look for interesting subjects at Christmas. They are all around him. Everything connected with the Yuletide season—from wrapping up the gifts to tucking the tired children in bed late on Christmas Day with their toys all around them—lends itself to striking photographic treatment. The fact that many of these pictures must be taken indoors is now no handicap. Photoflash and photo-flood bulbs, together with modern high speed films, have made it easy to take such views without danger of failure.

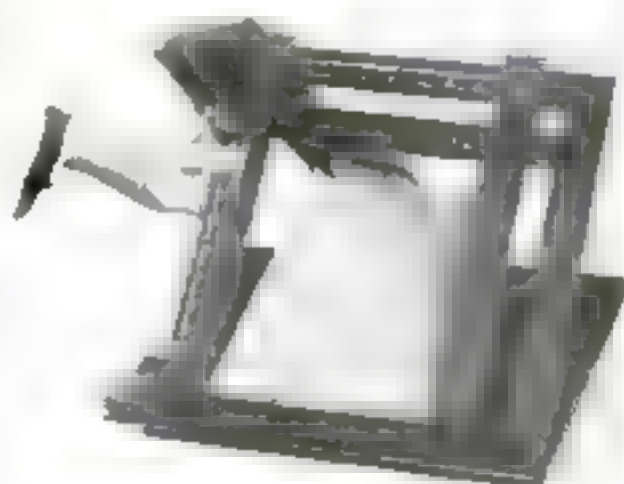
See what you can do this Christmas,

Write on the back of each print your name and address and what type of lighting was used—daylight, photoflash bulbs, photo-flood lamps, or other artificial illumination. No prints will be returned unless a self-addressed, stamped envelope is inclosed. The contest is open to any amateur photographer except employees of POPULAR SCIENCE MONTHLY and their families. The developing and printing, of course, may be done by a professional. In case of ties, each tying contestant will be awarded the prize tied for

and enter your best prints in our new contest. The prizes will be as follows:

FIRST PRIZE	\$25
SECOND PRIZE	15
THIRD PRIZE	5
FIVE PRIZES, \$1 each	5

Mark your entry "January Photo Contest" and mail it to the Photographic Department POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York, not later than February 1, 1935. It is not necessary to send the films.



Any size enlargement from 8 by 10 in. down can be masked instantly with this adjustable holder.



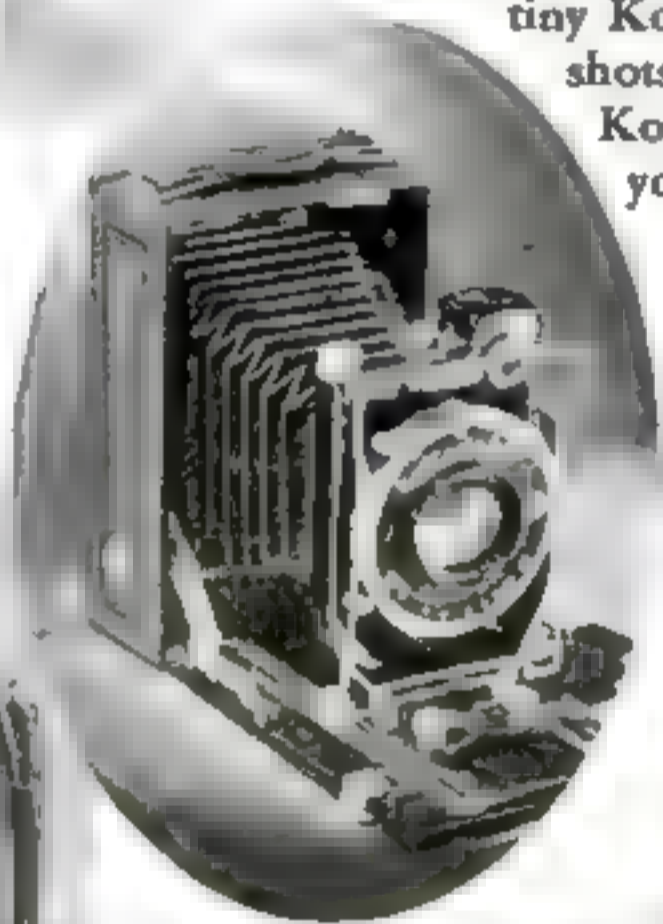
● **KODAK SIX-16 (f.4.5)**

—the camera for those who know. Snaps open at the touch of a button. The Kodak Anastigmat f.4.5 lens gives greater snapshot snap—and the Compur shutter a 1/250 second speed—snaps—miniature. Has both eye-level and reflecting finders. A self timer lets you get in the picture yourself. For 2 1/2 x 4 1/4 inch pictures—\$40.

# Gifts

## YOU'LL WANT TO GIVE —AND GET

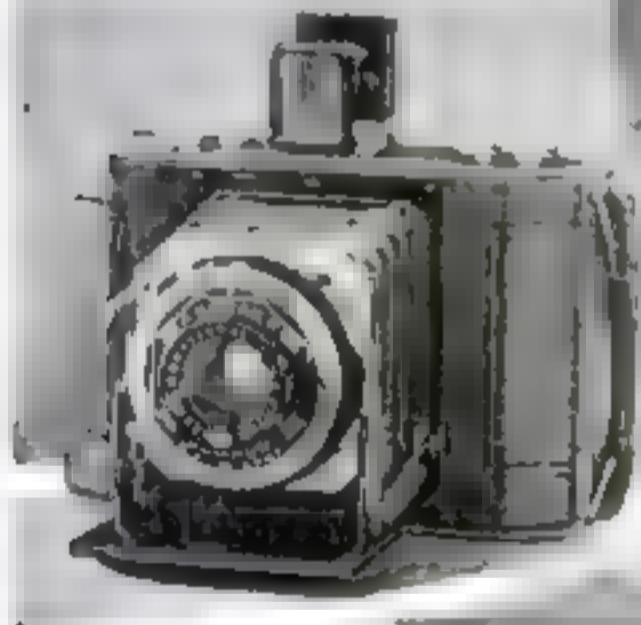
● IT'S CHRISTMAS...Kodaks are on parade. Precision Kodaks with fine, fast lenses... inexpensive Kodaks for beginners... tiny Kodaks for miniature snapshots. Brownies as low as \$1; Kodaks, \$5 up. See them at your dealer's. Give a Kodak.



● **KODAK RECOFLEX "16" (f.4.5)**—most versatile of Kodaks. With f.4.5 Kodak Anastigmat lens... 1/250 second Compur shutter. Double extension bellows for close-ups—supplementary long-focus and wide-angle lenses may be used. Ground-glass focusing. 1 sec. rat film, film packs, or plates. For 2 1/4 x 3 3/8 inch pictures—\$46.

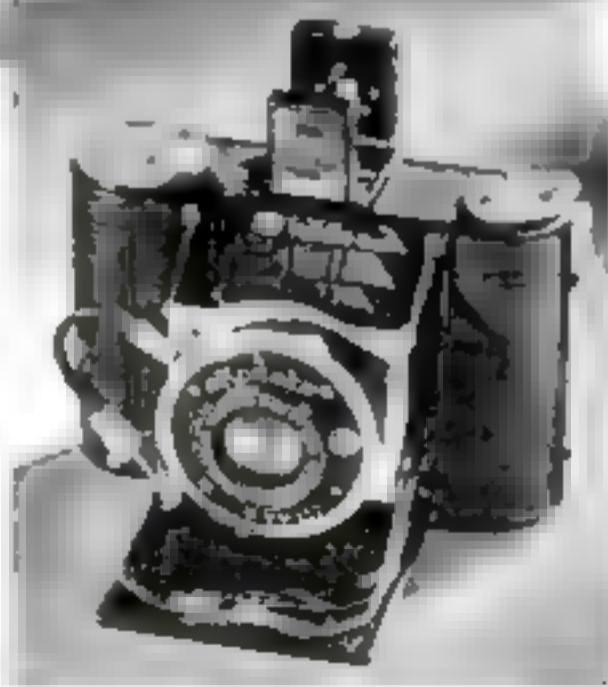


● **KODAK SIX-20 (f.6.3)**—sums up years of camera development—styled for 1935. The f.6.3 Kodak Anastigmat lens gives crisp, clear snapshots. Simple to use—it opens at the touch of a button. Has 1/100 second shutter. Eye-level and reflecting finders. For 2 1/4 x 3 1/4 inch pictures—\$17.50. Other models from \$14.



● **KODAK DUO SIX-20 (f.3.5)**—a true miniature camera—small, convenient—yet it makes a larger, album-size picture. Takes sixteen 1/4 x 2 1/4 inch pictures on a roll of 620 film. f.3.5 Kodak Anastigmat lens. 1/300 second Compur shutter... \$52.50.

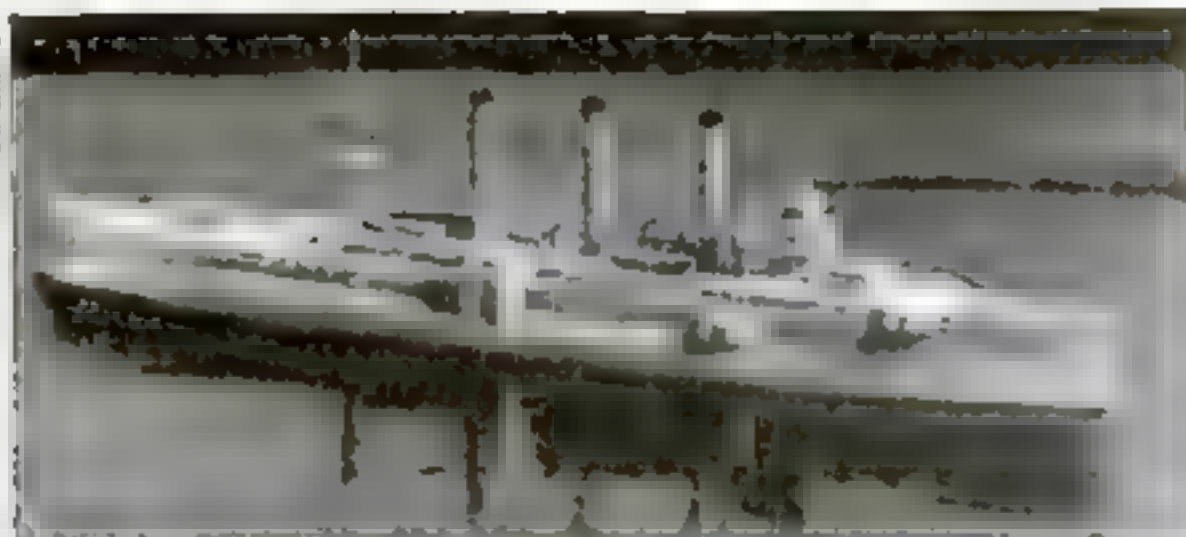
● **KODAK VOLLENDA (f.3.5)**—a fine miniature camera. Takes sixteen 1 3/16 x 1 9/16 inch pictures on a roll of "vest pocket" film. Eight-speed Compur shutter. f.3.5 lens. eye-level finder. Price—\$33.50.



### GIFTS GALORE

Send today for catalog showing all latest Kodaks. Mail this coupon to Eastman Kodak Co., Rochester, N. Y.

Name \_\_\_\_\_  
Street \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ P.S. 1-12

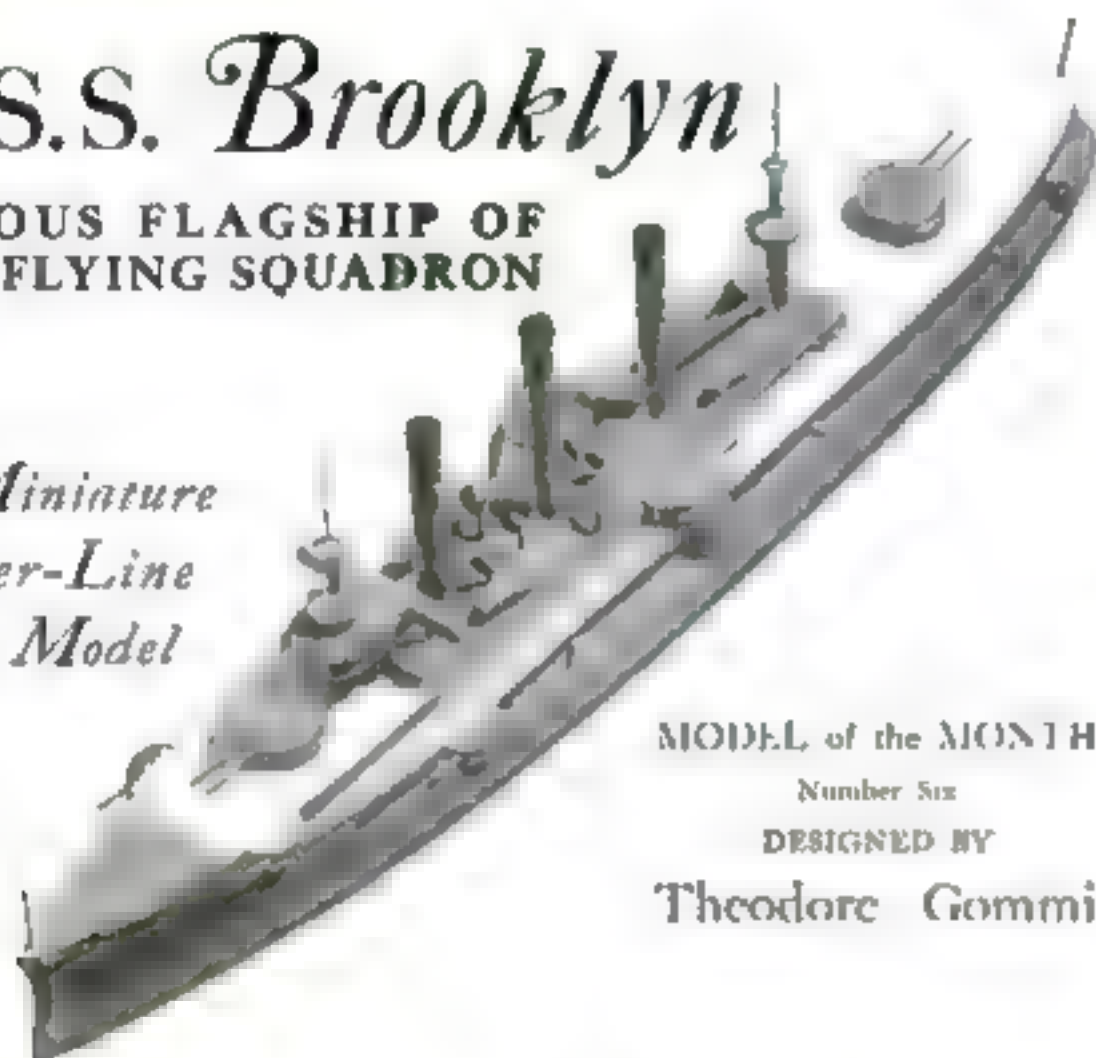


It would be difficult to find a more realistic little model than this one of the old U. S. S. *Brooklyn*. It is 5 in. long and made of balsa.

# U.S.S. *Brooklyn*

FAMOUS FLAGSHIP OF  
THE FLYING SQUADRON

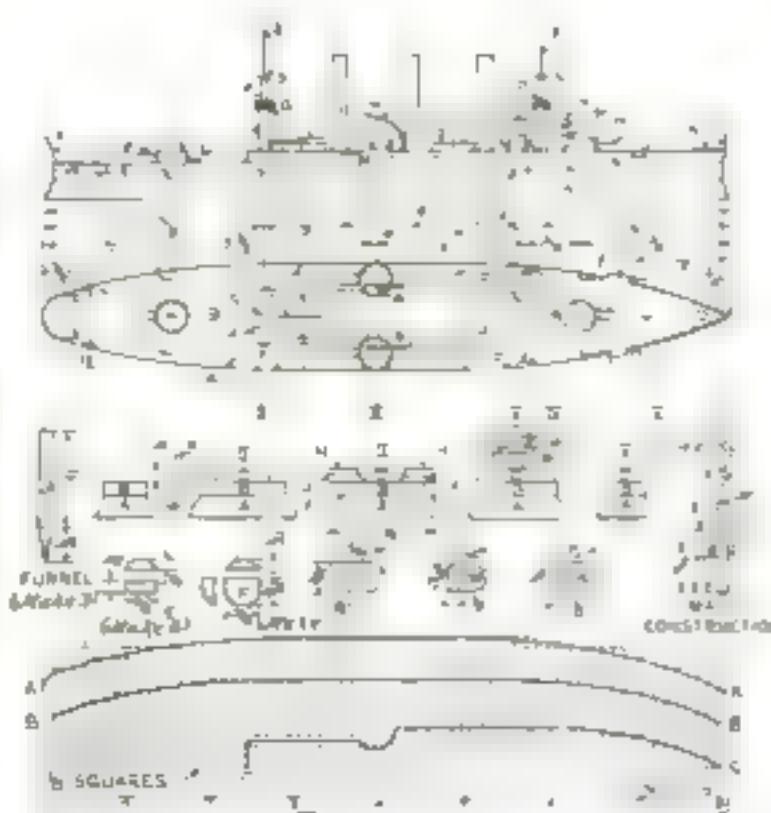
*A Miniature  
Water-Line  
Scale Model*



MODEL of the MONTH  
Number Six  
DESIGNED BY  
Theodore Gomme

**T**HE January project of the Popular Science Model-of-the-Month Club is the old armored cruiser *Brooklyn*, pride of the United States Navy in the nineties. Because of her deeds in the Spanish American War, she is well worthy of a place in any group of historic American vessels.

As soon as she was completed, the *Brooklyn* was sent to England to represent the Navy at the Diamond Jubilee Review held in Queen Victoria's honor. While there she took her share among the proudest and mightiest warships of the world. Many of innovations that were included in her construction were soon adopted by other nations. She was hardly back in home waters when the outbreak of the Spanish American War found her the flagship of the Flying Squadron, which did such valuable service in the conflict, especially at the battle of Santiago.



Side and top views of the model, cross sections at lines 1 to V, various details, the plotted profiles, and a scale.

The *Brooklyn* must have made a wonderful appearance in her day, as she plowed through the waves with her ram-shaped bow, her sides fairly bristling with guns, and much black coal smoke pouring out of her three tall funnels. She was not a small ship, by any means. Still, one cannot help compare her, since her displacement was almost 10,000 tons, with modern cruisers such as the *Tuscaloosa* (see P.S.M., Nov. '34, p. 73) and note the vast improvement that has been made in size, speed, and power.

Like the previous models in this series, the *Brooklyn* is on the scale of 1 in. equals 50 ft., and the same general method of construction is used. Balsa wood  $\frac{1}{4}$  in. thick is used for part 1;  $\frac{1}{16}$  in. thick for B,  $\frac{1}{8}$  in. thick for C, E, A, and D;  $\frac{3}{32}$  in. thick for F, H, and I;  $\frac{1}{16}$  in. thick for G, L, M, and N; and  $\frac{1}{32}$  in. thick for D. The masts each consist of one piece of aluminum or brass tubing  $\frac{1}{8}$  in. outside diameter,  $\frac{1}{16}$  in. inside diameter, and 1  $\frac{1}{16}$  in. long, marked J; one piece of tubing  $\frac{1}{16}$  in. outside diameter,  $\frac{1}{32}$  in. inside diameter, and 1  $\frac{7}{16}$  in. long, a needle, marked P, three washers Q  $\frac{3}{16}$  or  $\frac{1}{4}$  in. diameter, and a cardboard, fiber, or metal disk S  $\frac{1}{2}$  in. diameter. Funnels J are  $\frac{5}{16}$  in. diameter dowels.

Paint the entire model a battleship gray. When dry, paint over the exposed portions of the rigging of B a light buff. Also paint the same color over C from underneath the flying bridge D to within about 1 in. of the bow. Paint a thin black band around the top of each funnel, and touch the heads of the pins used as ventilators V with black.

A complete construction kit containing all the necessary balsa wood and other materials, the paints, a full-size blueprint, detailed instructions, and an itemized list giving the exact size of all parts, may be had for 75 cents, postpaid (see page 71). These kits have been specially designed and made for the Model-of-the-Month Club, but other readers can obtain them, while the supply lasts, for the same price.

The full-size blueprint, detailed instructions, and completely itemized list of materials are also available separately for 25 cents. Order Blueprint No. 136.

Members of the Model-of-the-Month Club are entitled to receive a copy of the instructions free, provided they send a self-addressed, stamped envelope.

## UNIQUE VENEERS MADE FROM COATED CLOTH

IN VENTURING various projects made in the home shop, little attention has been given to the novel and very attractive effects that can be obtained by using cloth as a covering. Cloth can be had in so many different weaves, colors, and designs that the possibilities are unlimited. The following method has been found suitable for converting any type of cloth into a veneer that will not wrinkle or crack.

The cloth is first stretched on a wood frame so that it is held perfectly taut. With a wide brush it is then quickly coated and soaked with a solution of celluloid. This is made by dissolving scrap celluloid in acetone to give a liquid of the consistency of syrup. To each pint, five drops of castor oil are added and thoroughly mixed. After the cloth is dry, it should be given one or two more coats, according to the thickness of veneer desired.

The sheet may then be cut into usable sizes with ordinary shears and cemented with the same solution to the object it is to cover. The surplus can be trimmed off neatly with a razor blade.

The material is suitable for covering any type of wood or metal project, and can be given a finishing treatment with lacquer, varnish, or enamel. In case enamel is used, thin it down considerably so that the fabric design will not be hidden beneath a solid mass of pigment.—OLIVER BANDELIER.

# FOR CHRISTMAS

## GIVE YOURSELF THIS NEW GENERAL ELECTRIC COMPLETE WORKSHOP

**No belts • No pulleys • Six machines in one, instantly interchangeable • Nothing else to buy**

Never before have so many practical working features been included in a motorized workshop. Every attachment is driven directly from the G-E motor. No frictional power losses or vibration to interfere with accurate work. Compact but sturdy, reinforced steel cabinet gives firm support.

### SIX MACHINES IN ONE

1. Lathe saw with 10" diameter, 2. Dr. saw, 3. Sanding table, 4. Motor bench, 5. Table saw, 6. Grinder. All of these machines work from one motor, and are interchangeable in a matter of seconds. The G-E Complete Workshop is a complete workshop in one.

See It At  
Your G-E  
Refrigerator  
Dealer's

### COMPLETE . . . ECONOMICAL . . . ACCURATE

**Y**OU are through buying when you get this complete outfit. Motor bench, and all tools come with it. Made for the professional or amateur woodworker, the small shop or the home craftsman. Equally efficient for all, because the vast resources of General Electric Company contributed to its painstaking development. Look at that motor. Though compact, it is a high-efficiency ball-bearing motor with  $\frac{1}{2}$ " shaft reduced to  $\frac{1}{4}$ " at the bearings. It gives continuous flow of power always at the cutting edge because of the powerful torque and inertia of its armature.

Surprisingly low current consumption cuts down operating cost to a level never before achieved.

Imagine—a complete power workshop which takes a floor space of only 18 by 36 inches! When you see it demonstrated—at your nearest G-E refrigerator dealer's—you will marvel at its completeness, its all-round efficiency, its practical working features, its ruggedness—and, with all these things, its amazingly low price.

## FREE!

### MAIL COUPON BELOW

for illustrated  
book with full  
story of G-E  
WORK-  
SHOP



### COMPLETE G-E WORKSHOP

Motor Bench Tools  
**\$10.00** DOWN  
Balance in Easy Payments

General Electric Company  
Nela Park, Dept. PE 1  
Cleveland, Ohio

Please send me FREE your book describing complete G-E WORKSHOP.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**COMBINATION BAND AND DR. SAW.** for wood or metal. Table tilts 45°. Self-aligning overhead arm quickly secured by single bolt. Saw chuck holds machine tool with round shanks up to 1-inch diameter. Greatly increasing wide scope of machine. Band saw can be attached in 5 seconds.

**CIRCULAR SAW** 8" diameter, direct motor driven lifting table 18" x 14", easily set for depth of cut and for any bevel up to 45°. Adjustable protractor and mitre gauge. Self-aligning guide with table calibrated in inches. Front and rear, self-setting safety-guard.

**LATHE** swings work up to 8" diameter, turning lengths with extension up to 30". The face plate fitted with removable cone and spur centers, screws directly on motor shaft or is carried on special mandrel held in chuck.

**BANDER TABLE** is grooved for the mitre gauge and rip guide of the saw and is slotted for metal cutting saws or milling cutters. The 8-inch sanding disc screws directly on motor shaft or is carried by the arbor held in chuck.

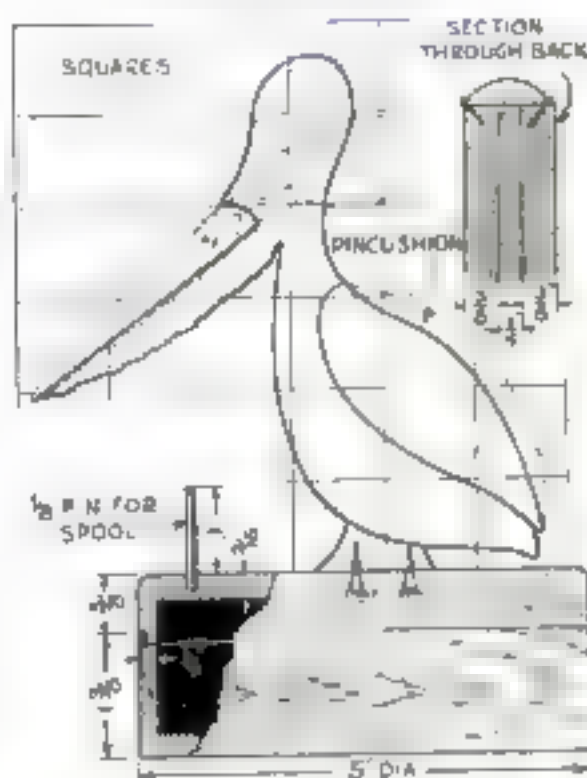
**QUICK CHANGE ATTACHMENT CLAMP** makes the attachment of the sanding table, sander or rip saw and tool post a matter of a few seconds. Construction is rigid and easily adjustable.

# GENERAL ELECTRIC



## NOVEL GIFT SEWING KIT

(Continued from page 77)



The sewing kit. To lay out the bird full size, draw with squares and copy from point to point.

the piece follows the lower edge of the scissors. The three pieces are glued together and, when dry, filed and sanded to shape.

The box is turned in the usual way (see P. S. M., July '34, p. 86). About six 1/8-in. dowels or brass pins are fastened in a circle to the lid as shown. These are for the spools most frequently used. The pelican is finally fastened to the center of the lid.

## HOW TO PREPARE PHOTOS FOR USE ON CRAFTWORK

ANY kind of craftwork of light color and smooth surface may be ornamented with genuine photographs, either singly or grouped to form a design.

The selected negatives are first printed on slow plates in the same manner that prints would be made on paper. After they are developed and dried, they will form positive pictures on glass. These are bathed for half a minute in the following solution: To 12 oz. of water add, in the order given, 1/2 oz. potassium carbonate; 1/4 oz. pure glycerine; 3/4 oz. formaldehyde, 40 percent strength.

The plates should then be drained and the excess solution removed with antiseptic blotting paper or charcolis. After they are dry, use a knife or razor blade to cut through the film around the outside of each plate, 1/4 in. from the edges. By inserting the blade edge under the gelatin film at one corner, it may be gently stripped off and kept in a book until used.

The gelatin films, which show the photographs in black against a transparent ground, are exceedingly thin. They should be trimmed to size with scissors while held between two sheets of writing paper, then applied to glass surfaces with a gum arabic solution, or to other surfaces with either white shellac or clear varnish. The entire surface should afterwards be given a coat of the shellac or varnish, which will effectively conceal the method used. The films may be colored or tinted with water color or oils, if desired, in the same manner that photographs on paper are treated.—GEORGE S. GREENE

## TESTING MOTORS BY SOUND

FAIR knocks or grinds in motors or gear boxes can be clearly heard if the mechanic places a flat steel scale or a metal rod between his teeth and rests the free end against work to be tested.—HAROLD C. BLAIR

# Make your own Christmas card with G-E MAZDA PHOTO LAMPS



How this card was made! The tree was cut out of composition board, because a regular tree does not produce a simple silhouette. It was placed before a light colored wall with a G-E MAZDA Photoflash lamp behind it, directed at the wall. When the pose suited, the lamp was flashed. Another method is to put a sheet over a doorway behind the subjects and to flash the lamp on back of the sheet.

Christmas cards are easy to make . . . and loads of fun . . . thanks to G-E MAZDA Photo lamps.

These magic lamps open scores of possibilities for creating "different" cards . . . as well as for capturing happy moments the year 'round . . . through INDOOR PICTURES.

G-E MAZDA Photoflood lamps, used with supersensitive film, enable you to take dozens of pictures at night . . . SNAPSHOTS, if you use a camera with a fast F/6.3 (or faster) lens; TIME EXPOSURES of one or two seconds, with box or slow lens folding cameras. Excellent for taking home movies.

FOR BABIES, PETS and action scenes, you need G-E MAZDA Photoflash lamps. They make such pictures as easy as snapshots in sunlight. Use them anywhere (operate on batteries or house current) with any camera which can be set for "time." Each lamp gets one picture, 15 cents list.

Your druggist or camera dealer can supply you with lamps and film. General Electric Company, Nela Park, Cleveland, Ohio.

## GENERAL ELECTRIC MAZDA PHOTO LAMPS

FREE FOLDER "How to Snap Pictures at Night" . . . tells which lamp to use and where to put it . . . filled with helpful information. P.A.M. 1-5

General Electric Company, Dept. 166, Nela Park, Cleveland, Ohio

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_



G-E MAZDA Photoflash lamp



G-E MAZDA Photoflood lamp



# "YES!

## FORDS AND CHEVROLETS CAN HAVE PUROLATOR PROTECTION"

This is in answer to the many inquiries that come to us from Ford and Chevrolet owners.

Fords and Chevrolets are not equipped with an oil filter at the factory . . . but your own service garage is now prepared to furnish and install a Purolator Oil Filter . . . especially designed and engineered for these two jobs.

### AND YOU COULDN'T MAKE A BETTER INVESTMENT

If you are using a good grade of oil a genuine Purolator Filter will keep it so clean and effective you can safely lengthen the time between crank case drainings.

Your Purolator will catch and hold the dirt and grit and fine metal particles and hard carbon that settles in crank case oil . . . will keep these grinding, abrasive substances out of the oil stream and away from your engine . . . will lengthen its life and its smoothness of operation.

It is these destructive settlements that wear out bearings, score cylinder walls . . . cause costly repairs and replacements . . . send many a car to the junk heap, long before its time.

The economy, the long life and the satisfying smoothness of operation developed by the use of a Purolator Oil Filter is already known to millions of experienced motorists. For its use as original equipment is no longer confined to high-priced cars. Apart from these two makes, more than 70% of all cars sold in this country during the first six months of 1934 left the factory equipped with a genuine Purolator Oil Filter.

The cost of a complete Purolator Filter, especially designed for Ford and Chevrolet passenger cars or trucks and including all the necessary fittings, is only \$5.00, plus a small charge for installation.

It will pay for itself many times over . . . both in actual dollar savings and in satisfaction.

If your own favorite service garage hasn't yet been supplied with this material, just clip and mail this coupon.

We will tell you how you can be promptly served, and will also send you an "Auto Almanac" . . . an unusual booklet . . . interesting and instructive.

## PUROLATOR

The Oil Filter on Your Motorcar

Licensed Under Sweetland Patents

### ADJUSTABLE CUTTING BOARD FOR GLASS



The adjustable straightedge is held firmly in place, thus assuring a straight, clean cut.

A PIECE of  $\frac{1}{2}$  in. thick insulating board about 18 in. square with an adjustable straightedge as shown forms a convenient device for cutting small panes of glass. In making the guide, four pieces of wood  $\frac{1}{4}$  by  $1\frac{1}{4}$  by 18 in. and four pieces  $\frac{1}{2}$  by  $\frac{1}{4}$  by 18 in. are needed. One piece of the heavier material is nailed to the base to serve as a backstop for the glass. To this is hinged another piece which holds the bolts with thumb nuts for adjusting the length of the guide strips. These strips are ruled off in inch and quarter-inch marks for convenience.

In use, the straightedge, which is nailed to the guide strip, is adjusted to the desired size and the thumb nuts are tightened. After the piece has been cut, the whole guide is lifted up, leaving the base clear for use in tapping and breaking the glass.—EUGEN PEARSON



The straightedge is hinged so that it may be lifted easily for placing or removing glass.

### COLORING BRASS AND COPPER

There is one really permanent color that may be applied to brass or copper. Although this requires quite a little work, it is well worth the effort.

Fill any wide-mouthed glass container not more than half full of commercial nitric acid and put into this all the scrap copper that the acid will consume. Do this out of doors and be very careful not to get the acid on the hands or clothing. When the acid is ready either dip the pieces to be colored into it, or coat thoroughly with a swab. Then heat them evenly until they take on, first a green, then a dark brown color. This is best done with a blowtorch, and the heat should be turned off the moment that the whole piece is brown.

Let the work cool, brush off the acid dust, and repeat. Sometimes three or four applications are necessary to obtain an even black. Finally, dust off, apply a good floor wax, and polish.

This finish surpasses any enamel and will not discolor. There is nothing that will affect it except fire or acid.

With hammered copper, the work should be gone over with jeweler's fine emery paper to bring out the copper high-lights before it is waxed and polished.—DICK HUTCHINSON

MOTOR IMPROVEMENTS, INC.  
Newark, New Jersey

I am interested in a Purolator for  
(check here) Ford Chevrolet

Send me without any obligation, further  
data, together with a copy of "AUTO  
ALMANAC"

Name

Address

City State

Notes: Trucks and passenger cars take  
same model.

## HOMESWORKSHOP GUILD

(Continued from page 74)

had been completed before the club was organized. Mr. Boger's project was a round table picture frame of vermilion wood. The club as a whole did not enter competition in the fair, but it was nevertheless awarded a special blue ribbon for merit. In open competition the members took seven first prizes and six second prizes. About 1,500 visitors a day for the six days of the fair saw the club's moving picture, which ran continuously. It showed the members of the club at work doing wood turning, hammered metal work, model ship building, photomicrography, welding, and show-card lettering. The Topeka Club has received as many as ten applications for membership at a single meeting.

**M**ETHODS of wood veneering were demonstrated by Guy H. Moore at a special meeting of the Tucson Homeshop Guild, Buffalo, N. Y., recently, and at a later regular meeting Professor Hammond gave an illustrated lecture on the pouring of the 200-inch lens for the new California Institute of Technology telescope. The club has been invited to use the clubrooms and facilities of the Buffalo Engineering Society in the Hotel Statler. In appreciation of this generous offer, the club invited the 400 members of the Engineering Society to attend one of its meetings in a body, and the invitation was accepted.

The Tucson Homeshop Guild of Tucson, Ariz., is now meeting regularly once a week. Permission has been obtained to use a public school manual training shop, when desired, at a small fee.

The Eugene Craftsman Guild of Eugene, Ore., has been offered the high school shop classroom for meetings whenever desired. This tender was made by Dr. O. N. Mickelson. An invitation has been accepted from Mrs. Ralph Pierce to visit Mr. Pierce's machine shop, where a demonstration will be given on the drill press, lathe, and stamping machine.

The Billings Homeshop Club of Billings, Mont., has outgrown its meeting place and is now planning either to rent one or construct a club building of its own. Its shop equipment was recently increased by a lathe, a circular saw, and a planer.

The Homeshop and Modelmakers' Guild of Richmond, Va., was given a display booth at the 1934 Virginia State Fair.

The Jacksonville Homeshop Club of Jacksonville, Fla., gives added interest to its meetings by awarding an attendance prize to the holder of the lucky number. As a club project, the members are constructing a cabinet to hold the magazines, books, and catalogs that are rapidly accumulating in the club library.

The Elizabeth Homeshop Guild of Elizabeth, N. J., is working on plans for an exhibit and also looking for a permanent home that will be convenient for carrying on its expanding program of activities.

Detailed information about the Guild and how to organize a club and obtain a charter will be sent to any reader who fills out the following coupon.

National Homeshop Guild  
c/o Popular Science Monthly  
301 Fourth Avenue, New York, N. Y.

I am interested in the home workshop club idea and wish to know what the National Homeshop Guild will do for me. Please send me this information in the large self-addressed and stamped envelope I am enclosing.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_  
(Please print very clearly)

# New Drill Press

## New "DELTA" Models Now Complete Full Line of Modern Drill Presses

Two new "Slo-Speed" Drill Presses together with other models now makes available Delta Drills for every purpose—in home workshop and factory alike. A Delta Drill Press is almost a complete workshop in one tool. It can be used for mortising, routing, drilling, carving, sanding, shaping and surface grinding. Delta Drill Presses embody Delta "quality" throughout—and yet are priced at unusual low price levels. Send for catalog. See coupon below.

## A Complete Line of Motor-Driven Woodworking Tools

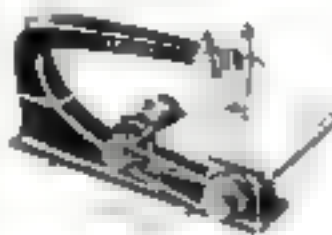
"Delta" Woodworking Units are convenient, portable and compact. All are available in a large variety of combinations and at prices to fit all needs. The "Delta" line includes: Jointers, Band Saws, Scroll Saws, Circular Saws, Woodturning Lathes, Drill Presses, Boring Machines, Sanding, and Mortising Attachments—and a full line of accessories.

### New 6-Inch Jointer



The new Patented Fence and many unusual improvements.

### New Scroll Saw



Cuts with finest jeweler's blades at full motor speed. Many other features.



There's no estimate as to the value of a Delta drill press. It's the only one of its kind at which machine of this quality were offered.

The splendid, clean lines of this latest member of the "Delta" family are indicative of the high quality and good workmanship built into this "Delta" Drill Press.

## SEND FOR CATALOG

The 1935 catalog of Delta quality motor-driven tools is now off the press. It is crowded with photographs and information about the new line of 1935 Delta tools. It shows how Delta tools are built to stand the grind of workshop work and yet are so low priced as to be within the reach of all.

Send coupon so your name will be placed on the mailing list to receive the 1935 Delta catalog without delay. Enclose only 10c at same time for Book of Practical Delta Projects, 32 pages of text and 100 drawings to make with handy line prints, working drawings, photographs and illustrations—and complete directions.

**Delta Manufacturing Company**  
Dept. B135.

3775 N. Halsted St. Milwaukee, Wis.

### DELTA MANUFACTURING COMPANY

3775 N. Halsted St., Milwaukee, Wis. Dept. B135

I enclose 10c (stamps or coins) for which please send me one copy of "Practical Delta Projects". I will place me on your mailing list to receive 1935 Delta catalog of quality motor-driven woodworking tools.

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

(Check here if you are a Delta user now.)

# Plans *for* Last-Minute Christmas Gifts

Please print your name and address clearly.

*Colorful Wheels of*

# INDUSTRY

**GRINDING WHEELS.** Yes, they're vital to industry — over two hundred grinding operations in the making of an automobile — they grind on every type of product from a needle to a battleship.

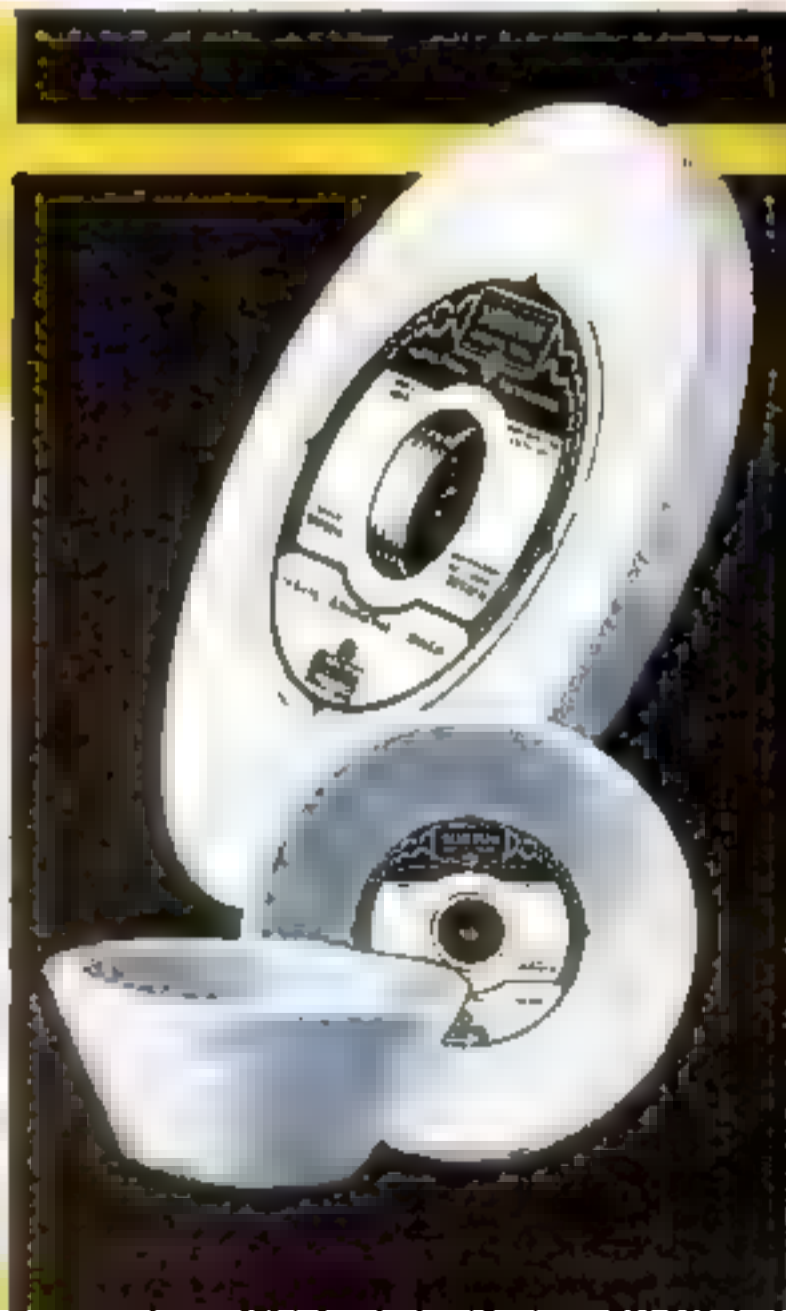
Millions of grinding jobs in the world mean millions of grinding problems — abrasive problems — *Norton Abrasives.*



*Sound Advice to*

## Management

Keep an eye on the wheels of industry — on vital production tools — on grinding wheels. Low cost and correct grinding go hand in hand — with *Norton Abrasives.*



# Norton Abrasives~

*Where they fit in Industry*

## Alundum Abrasive (crystalline aluminum oxide, $Al_2O_3$ )

Combines hardness and toughness—the most widely used of all abrasives. A product of the Norton electric furnace abrasive plant.

## Crystolon Abrasive (silicon carbide, SiC)

Its hardness and special characteristics make it supreme in certain fields such as stone, ceramics and the cemented carbides. Also a Norton electric furnace plant product.

## Norbide Abrasive (boron carbide, $B_4C$ )

The hardest material ever produced by man for commercial use—an exclusive Norton product.

## Bortz Abrasive (commercial diamonds, crushed and sized)

The world's hardest known natural product. Its field for grinding and lapping is the modern cemented carbides.

**NORTON COMPANY, Worcester, Mass.**

Behr-Manning Corporation and Norton-Pike Company  
Troy, New York, are Divisions of Norton Company



## Leading NORTON ABRASIVE Products

Norton Grinding Wheels head the procession—at work in every metal working industry—edging machine shop tools, sizing and finishing thousands of machine parts, cleaning or snagging rough castings of iron and steel and cutting off bar stock. And in the industries of lumber, stone, glass, agriculture, paper and leather they have their work to do.

Sharpening Stones (India Oilstones)  
Rubbing Bricks and Blocks—tools of the factory, workshop and home.

Abrasive Grain for Polishing—thousands of tons annually to polish the industrial world's metals.

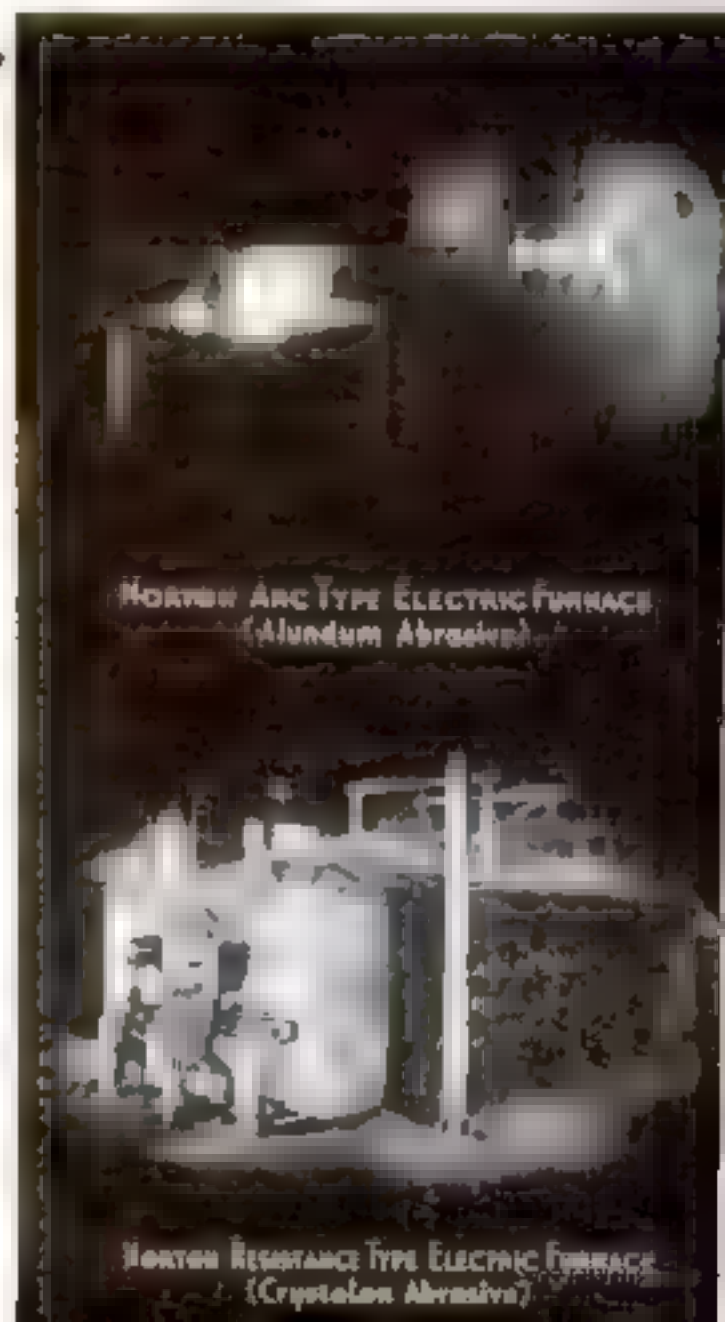
Abrasive Paper and Cloth (sandpaper)—another product for factory, workshop and home.

Norton Refractories and Laboratory Ware—for the efficient handling of heat in industry.

Norton Porons Plates and Tubes—important in sewage disposal plants (activated sludge type) and in industry for aerating, filtering and diffusing.

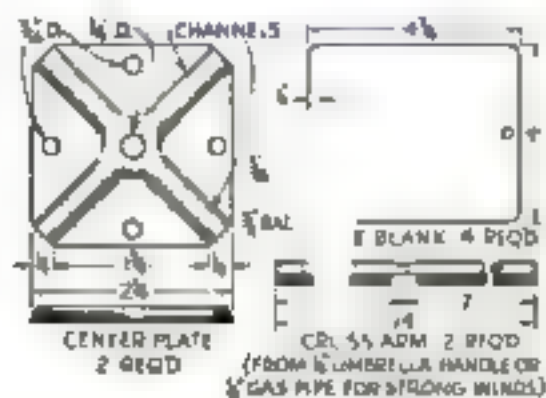
Norton Pulpstones—for converting logs of the forest into wood pulp for the newsprint industry.

Norton Floors—Alundum Tiles, Treads and Aggregates that make walkways non-slip and durable.



## MAKING A WIND GAUGE

(Continued from page 45)



A pattern for cutting the four vane blanks, the arms, and the plates that hold them rigid

the four revolutions have been calibrated, lay the dial over a suitable piece of card board and transfer the points and circle center by pricking through with a needle. Then ink in the circles and divisions on the card-board, cut out the dial, and mount it on a plywood base, fitting it for installation.

If the anemometer is to be portable, screw the housing directly to the dial, and leave the wire index hand in place. It can then be set in any desired place to test the wind, and can be used to calculate the flow of air in ventilating ducts or between buildings. If the wind is steady the hand will practically come to rest over the mark showing the velocity; but if gusty, the vanes will oscillate and the average of the swing will be read.

To mount the anemometer on a building, such as the garage, bolt the housing to a suitable block to straddle the ridge boards or to level it on the slope of a shed roof. Bore a 1-in. hole through the roof for the index spindle, and, before mounting the instrument, solder this spindle in the end of the bolt spindle. Thrust it through the hole, smear the underside of the block with roofing tar, nail it securely, and coat the outside with tar. Put a temporary shed or cover over the instrument to shield it from the wind until the dial is set.

Mount the dial upside down under the roof or ceiling. For this use, of course, it must be calibrated in the opposite direction to one used for a portable instrument. Since the vanes are free to swing through more than one revolution, a telltale is needed to show what circle is to be read. This consists of two clock wheels. A small pinion, drilled to fit the index spindle, is pushed up close to the dial and soldered. The large gear is mounted on the dial in mesh with the other by driving a nail through the center, and a hand is pointed on one spoke. Mark the dial "1" to correspond, count around as many teeth as there are teeth on the pinion, and mark "2." Likewise locate "3" and "4."

The hand may be soldered or screwed on.

Table of Squares

V	V <sup>2</sup>	V <sup>2</sup>	V <sup>2</sup>	V <sup>2</sup>	V <sup>2</sup>
1	1	20	400	39	1521
2	4	21	441	40	1600
3	9	22	484	41	1681
4	16	23	529	42	1764
5	25	24	576	43	1849
6	36	25	625	44	1936
7	49	26	676	45	2025
8	64	27	729	46	2116
9	81	28	784	47	2209
10	100	29	841	48	2304
11	121	30	900	49	2401
12	144	31	961	50	2500
13	169	32	1024	51	2601
14	196	33	1089	52	2704
15	225	34	1156	53	2809
16	256	35	1225	54	2916
17	289	36	1296	55	3025
18	324	37	1369	56	3136
19	361	38	1444	57	3249

## The TREASURE of BULLS EYE BEND

WISE BOYS, YOU TWO, WHEN YOU PICKED THESE NEW **BUCK JONES SPECIALS** TO TAKE ON THIS TREASURE HUNT, YOU'LL NEED THAT HANDY COMPASS AND SUNDIAL, TOO. THERE'S REAL TREASURE OUT THERE... **NOW GO GET IT!!**



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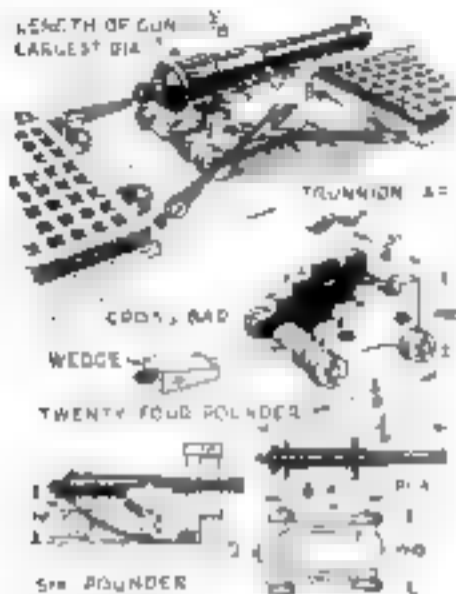
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**Daisys!**

# GUNS AND SPARS FOR OUR PRIVATEER

(Continued from page 69)



Large gun in place in carriage and details of the six-pounders

The gaffs and booms are thickest one third from the masts. The ends are slightly flattened to take the jaws, which are glued and riveted through and have holes in the ends for a cord parcel. At the end there is a cleat on either side to keep the sheets in position but still enable them to turn. Outside of these is an eye on either side for the boom topping lifts. For these, bore a horizontal hole, pass the two ends of a light of thin wire through, pass one end back, twist and cut the ends off. The eyes in the futtock bands and the deadeyes of the bowsprit shrouds can be made the same way.

The jib boom is thickest at the cap, has three holes for the stays, and a stop (step) for the martingale at the end.

The fore-topmast is octagonal as far as the cap, then tapers very slightly to the head, where there is a little stop, thus reducing the thickness, and another similar stop at the topgallant masthead, these, of course, form one spar with the pole. It is bored across near the end for the fid, which is a bar lying across the trestletrees to prevent it from slipping down. It is also bored fore and aft near the topmast and topgallant mastheads for the yard halcyards.

The main topmast is similar, except that there is only one stop (that is, no topgallant mast). It is drilled for the fid and sail topgallant halcyards. The other spars are for the rintangal (which may be omitted) and are like a stunsail boom and yard.

The dolphin striker (martingale boom) hooks into an eye under the cap. It has a stop near the end and wire eyes on each side, one third up.

TABLE SHOWING LENGTH AND GREATEST DIAMETER OF SPARS

	Fore	Main
Lowermast		
Foremast	6.5	16 x 10
Mainmast	6	16 x 10
Bowsprit	4	16 x 10
Jib boom	13	16 x 10
Martingale boom	1	16 x 10
Lower yard	5	16 x 10
Studding-sail boom	5	16 x 10
Topgallant yard	5	16 x 10
Booms	5	16 x 10
Gaffs	5	16 x 10
Center-reefs	5	16 x 10
Square mastheads	5	16 x 10
Total length of bowsprit and jib boom	17	

## KEY TO THE RIGGING

To save space the following abbreviations are used:

F	Fore	T	Topgallant
hal	halcyards	TG	topgallant
M	main	TSM	topgallant
P	port	TS	topgallant
S	starboard		

The parts are numbered as nearly as possible in the order of application to the model. Those printed in *italic type* should be applied to the last piece of material used. The parts of the rigging are indicated by a number in the margin, in many cases the parts are indicated by a number in the margin. The parts of the rigging are indicated by a number in the margin.

1 F mast	51 IT shrouds b
2 M mast	52 FT shrouds
3 Jib boom	53 FT shrouds
4 Fulle & band	54 FT shrouds
5 Fulle & band	55 F T shrouds
6 Fulle & band	56 F T shrouds
7 Fulle & band	57 F T shrouds
8 Fulle & band	58 F T shrouds
9 Fulle & band	59 F T shrouds
10 Fulle & band	60 F T shrouds
11 Fulle & band	61 F T shrouds
12 Fulle & band	62 F T shrouds
13 Fulle & band	63 F T shrouds
14 Fulle & band	64 F T shrouds
15 Fulle & band	65 F T shrouds
16 Fulle & band	66 F T shrouds
17 Fulle & band	67 F T shrouds
18 Fulle & band	68 F T shrouds
19 Fulle & band	69 F T shrouds
20 Fulle & band	70 F T shrouds
21 Fulle & band	71 F T shrouds
22 Fulle & band	72 F T shrouds
23 Fulle & band	73 F T shrouds
24 Fulle & band	74 F T shrouds
25 Fulle & band	75 F T shrouds
26 Fulle & band	76 F T shrouds
27 Fulle & band	77 F T shrouds
28 Fulle & band	78 F T shrouds
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30 Fulle & band	80 F T shrouds
31 Fulle & band	81 F T shrouds
32 Fulle & band	82 F T shrouds
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37 Fulle & band	87 F T shrouds
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40 Fulle & band	90 F T shrouds
41 Fulle & band	91 F T shrouds
42 Fulle & band	92 F T shrouds
43 Fulle & band	93 F T shrouds
44 Fulle & band	94 F T shrouds
45 Fulle & band	95 F T shrouds
46 Fulle & band	96 F T shrouds
47 Fulle & band	97 F T shrouds
48 Fulle & band	98 F T shrouds
49 Fulle & band	99 F T shrouds
50 Fulle & band	100 F T shrouds

The three caps are best made from fiber board, but rehard or box wood is almost as good. They should be a tight fit and keep the masts and jib boom parallel to the masts below where they double.

You can finish all spars in a natural color, stain them a reddish or brown and varnish them, or paint them white or black, except those sections of the masts where anything hoists. These and the jib boom are bright.

Next month we will put on the rigging and complete the model.



SAYS:

**NEVER** throw away short and seemingly worn-out tool bits; they come in handy for use with small diameter boring bars.

A good kitchen cleanser dissolved in warm water saves time in cleaning oily machinery prior to painting it.

An accurate setting of the compound rest for the purpose of boring or turning a duplicate taper can be insured by placing a taper sleeve or arbor between centers and using an indicator in the tool post.

When caliper a bore in cast iron, be sure that the stationary leg of your caliper is not resting in a spot that is slightly concave.

In general, the cutting speed for high-speed drills can be figured at two or three times the speed recommended for carbon steel drills.

If it becomes necessary to make a spring collet, remember that the slots should not be cut all the way out. Leave a light web to protect it from warping in heat treatment and during the internal and external grinding process. It is then a simple matter to use a thin elastic grinding wheel to finish the slots on the nose of the collet.

This tools or gauges should not be marked with an etching machine of the electric type as the heat may warp them. Stencil them before they are ground.

Any good mechanic who takes a piece of machinery apart can put it together again, but the fact is that he may not be on hand to do it. Always make it a practice, therefore, to stencil all parts when dismantling them.

## SUBSTITUTE FOR ROUND BELT MADE OF STRING

IN THE midst of a rush order that called for several days' work on my band saw, the 1/2-in. round leather belt broke several times, and I finally made a substitute of white store string. With two renewals, it has given good service for more than a year.

To make such a belt in an emergency, take about ten strands of the string about 1 ft. longer than needed. Hold one end and with the other hand smooth them out. Now tie a single knot about 1 ft. from the end, and continue tying single knots 1 ft. apart the entire length of the belt. Place the belt around the pulleys, bring the two ends together, and tie a double knot, pulling the string as tight as possible. This double knot will ride the small pulley smoothly, and the knots in the belt serve to keep the strands from breaking. With excessive use, the string belt will stretch considerably, and it is necessary to keep it rather tight. GEORGE L. RAYMOND.

## TOURING WINTER SKY WITH OPERA GLASS

(Continued from page 47)

the southern map in January. Alcol, or the Demon, goes through its changes in brilliancy in about nine hours. At its brightest it is a second magnitude star (like those in the big dipper's handle). It remains bright for two and one-half days. Then it fades for four and one-half hours and becomes an inconspicuous fourth-magnitude star, which it remains for a few minutes only. Its increase in brightness also takes four and one-half hours. The interval between times of minimum brightness is two days, twenty hours and forty-nine minutes, so you can calculate its periods ahead for yourself after observing one of them.

2. **PLEIADES** This beautiful little group is high on the eastern sky in December, and equally high on your map. The Pleiades were among the first objects studied by Galileo with his first telescope. He counted thirty-six stars in the group, which was beautifully described by Tennyson in the phrase, "a swarm of fireflies tangled in a silver braid." The Pleiades is a part of the constellation called Taurus, or the Bull.

3. **HYADES** This group, also in Taurus, is near the first magnitude star Aldebaran, which forms the Bull's eye. It is somewhat similar to the Pleiades. An opera glass gives you a beautiful picture, and a stronger field glass enables you to see many more faint stars, including several double stars.

4. **GREAT NEBULA in ORION**. This is only one of the many beauties exhibited by this magnificent star group, which hangs in the southeastern sky during December and January, and crosses to the southwest by March. No other constellation contains so many bright stars. Look for the nebula with your glass about half way down the row of stars which hangs like a sword from the famous belt. Even an opera glass will show you faint stars in the nebula itself, and a field glass makes them much plainer.

5. **GREAT CLUSTER in PERSEUS**. To see this lovely object we must return to Perseus. The cluster can be seen with the naked eye as a fuzzy star at the top of the constellation. An opera glass brings out some of the many faint stars, a field glass more, and a small telescope makes it a magnificent ball of stars.

6. **GREAT NEBULA in ANDROMEDA**. This famous object is located high in the western sky for December, when it should be observed, as by January it is on its way to the horizon. It can be seen with the naked eye on a moonless night. With an opera glass it shows as a wisp of light like that indicated in the small circle beside Map No. 8. The stronger the glass or telescope, the more beautiful and interesting the nebula becomes.

7. The **VARIABLE STAR MIRA**, in CETUS. Look for this star in the group called the whale, about half way to the mouth on your western map. It fades from the second magnitude to about the tenth, when it is invisible to the naked eye for five months. Eleven months are required for this long-period variable to complete its full cycle from maximum to maximum. No wonder the ancients named it Mira, or the wonderful one.

8. **STAR CLUSTERS in CANIS MAJOR**. Southeast from Orion, the blazing first magnitude star, Sirius, will guide you to a field that richly repays study with an opera or field glass. The cluster marked "41M" in the map is only one of several in the near neighborhood of Sirius.

9. **PRAESEPE, or the BEEHIVE in CANCER**. The faint constellation called Cancer, or the crab, is rising in the eastern sky during January, and about half way up the sky in February. At its center your opera glass will show you a crowd, or cluster, of lovely little stars, with a brighter one on each side. This

cluster is also called the Manger and the two stars the Ass's Colts, feeding from it. Galileo's telescope enabled him to count thirty-six stars in the Manger.

10. The **RADIANT of the LEONID METEORS**. Late in February you will see the constellation Leo, the lion, rising in the east. While you are sweeping the head or the saddle, note that this is the point from which the Leonid meteors radiate in November.

11. The Famous **NOVA in CASSIOPEIA**. Look for Cassiopeia high on the northern map. By February it has begun to sink toward the northwest. The Milky Way here is so rich that it repays much study with both opera and field glass. In Cassiopeia, in 1572, appeared a new star, or NOVA. In that year it blazed out and outshone even Sirius, then sank to invisibility in about a year and a half.

12. The **COAL SACK in CYGNUS**. Here also the Milky Way is glorious in a glass, but is marked by a black spot, called the coal sack. It may be caused by a cloud of dark nebulous matter.

13. **DOUBLE STAR in DRACO**. Northwest of the polestar, near the horizon in December, look for five stars forming the head of Draco, the dragon. One of these is double and is a good test for the power of an opera glass. Try this star again next summer when it will be better placed for observation.

14. The **WATER JAR in AQUARIUS**. You will find this striking little triangle above the southwestern horizon in early December. Sweep your glass southward and you will see a lovely stream of little sparklers, which represents the water being poured from the jar.

15. The **GARNET STAR in CEPHEUS**. This faint constellation is at the left and below the polestar in your Northern map. Map 15 shows the location of the Garnet Star, which is the reddest star visible to the naked eye. In the opera glass it can be found more easily and its color better appreciated. It is a variable with a period of six years.

16. **HORSE and RIDER**. The star at the bend in the Big Dipper's handle is the horse Mizar. The rider, Alcor, is immediately above it. The rider was also called the proof by the Arabs, meaning the proof of good eyesight if you can see it.

17. **STAR CLUSTER in GEMINI**. In the group called Gemini, or the twins, (eastern map) look with your opera glass near its western end for the cluster "45M" at the center of a gorgeous field of small stars. A field glass brings out more details.

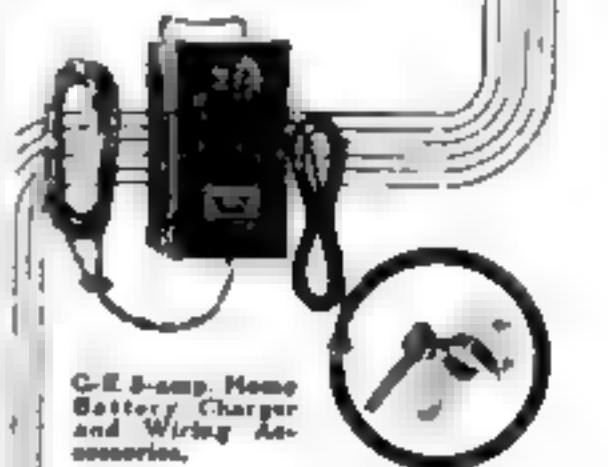
## FALSE RAINBOW CAUSED BY SUNLIGHT ON CLOUDS

Bright patches of color sometimes seen high up in the sky near the sun are not always rainbows, it is explained by Dr. W. J. Humphreys of the U. S. Weather Bureau. The false rainbow is usually richer than the true one in greens and reds. It is caused, not by the sun's light striking falling rain, but by its diffraction in the minute particles of moisture contained in filmy clouds. Though occurring rarely, Dr. Humphreys says, the false rainbow may be seen by a watchful observer once or twice a year.

## USE FOUND AT LAST FOR RARE METAL, INDIUM

NEARLY seventy years after its discovery commercial use has been found for the rare silvery-colored metal known as indium. Plated thinly upon electric lamp reflectors, it has been found to reflect lights of various colors with greater fidelity than any metal yet used for this purpose.

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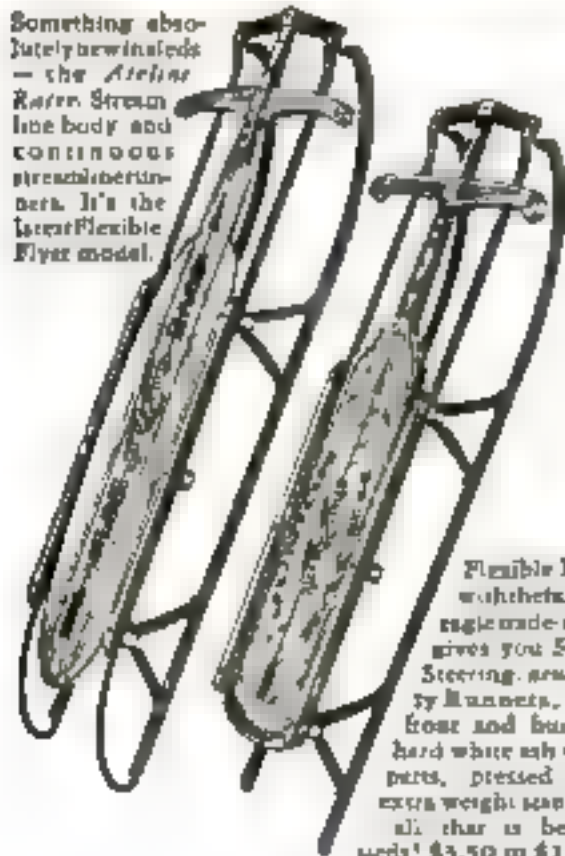
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## HERE'S THE ANSWER

(Continued from page 59)

### Removing Ink From Wood

**H. G., ANK ARBOR, MICH.** Ink spots in wood generally can be removed by washing the surface with a strong solution of oxalic acid. Make the solution by dissolving as much crystal oxalic acid in water as it will hold. When the spot has been bleached out be sure to remove all traces of the acid.

### Safety Match Striker

**N. W., MINNEAPOLIS, ILL.** An abrasive surface for use in scratching and igniting safety matches can be made easily by mixing red phosphorus (nine parts), pulverized iron pyrites (seven parts), pulverized glass (three parts), gum arabic or glue (one part) and water, spreading it in a thin coating on cardboard, and allowing it to dry.

### Pulling Out of a Skid

**P. S. K., JR., LYNDENBURG, VA.** To bring a car out of a skid, the front wheels should be turned toward the direction in which the car is skidding. If the motion of the skid is to the right, the wheels should be turned to the right. If it is to the left, the wheels should be turned to the left. In this way the rear wheels will be forced into line with the front wheels.

### No More Wash Days

**Q.—**Is it true that the government recalls paper money from time to time and washes it?—**L. P., Denver, Colo.**

**A.—**At one time the Treasury Department did launder bills to clean them and revive their crispness but this practice was abandoned several years ago because it shortened the life of the paper and faded the printing.

### Sun Not So Hot

**Q.—**Is the sun the hottest body in our heavens?—**R. B., Salem, Ore.**

**A.—**NO. There are blue hot stars with temperatures as high as six times that of the sun. Astronomers have located over seven hundred of these so-called blue-hot stars.

### Change Sex at Will

**E. F. D., ST. AUGUSTINE, FLA.** Strange as it may seem, oysters have no fixed sex. If she desires, a female oyster after tiring of the duties of motherhood can become a male. Likewise after several months of fatherhood she—or rather he—can return to the female state.

### Money Talks In All Countries

**Q.—**Is there such a thing as a universal language? What tongue is used at meetings of the League of Nations?—**I. O. P., Montreal, Quebec, Can.**

**A.—**French and English are the official languages of the League of Nations. Although a universal language named *Venapuk* was devised some fifty years ago it never met with world-wide favor. Another so-called universal language, "Esperanto," was devised by Dr. Zamenhof, a Russian, in 1887.

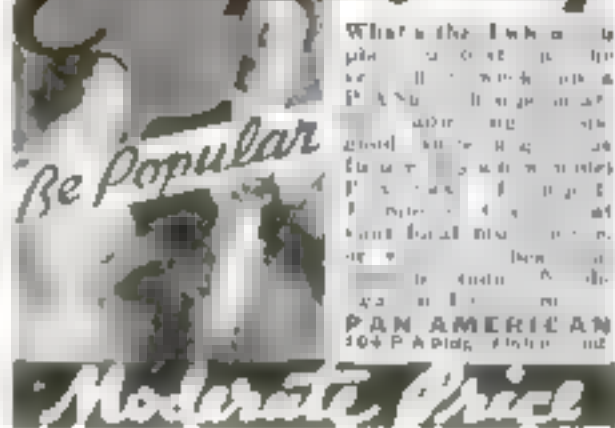
**THESE** questions from readers have been selected from the thousands answered by our Information Department. Due to the large number received each month, letters requesting information will be answered only when a stamped and self-addressed envelope is enclosed.

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1/2"</td><td>190.50</td></tr> <tr><td>190"</td><td>191.00</td></tr> <tr><td>190 1/2"</td><td>191.50</td></tr> <tr><td>191"</td><td>192.00</td></tr> <tr><td>191 1/2"</td><td>192.50</td></tr> <tr><td>192"</td>&lt;</tr></table>	Size	Price	1/2"	1.00	3/4"	1.50	1"	2.00	1 1/2"	2.50	2"	3.00	2 1/2"	3.50	3"	4.00	3 1/2"	4.50	4"	5.00	4 1/2"	5.50	5"	6.00	5 1/2"	6.50	6"	7.00	6 1/2"	7.50	7"	8.00	7 1/2"	8.50	8"	9.00	8 1/2"	9.50	9"	10.00	9 1/2"	10.50	10"	11.00	10 1/2"	11.50	11"	12.00	11 1/2"	12.50	12"	13.00	12 1/2"	13.50	13"	14.00	13 1/2"	14.50	14"	15.00	14 1/2"	15.50	15"	16.00	15 1/2"	16.50	16"	17.00	16 1/2"	17.50	17"	18.00	17 1/2"	18.50	18"	19.00	18 1/2"	19.50	19"	20.00	19 1/2"	20.50	20"	21.00	20 1/2"	21.50	21"	22.00	21 1/2"	22.50	22"	23.00	22 1/2"	23.50	23"	24.00	23 1/2"	24.50	24"	25.00	24 1/2"	25.50	25"	26.00	25 1/2"	26.50	26"	27.00	26 1/2"	27.50	27"	28.00	27 1/2"	28.50	28"	29.00	28 1/2"	29.50	29"	30.00	29 1/2"	30.50	30"	31.00	30 1/2"	31.50	31"	32.00	31 1/2"	32.50	32"	33.00	32 1/2"	33.50	33"	34.00	33 1/2"	34.50	34"	35.00	34 1/2"	35.50	35"	36.00	35 1/2"	36.50	36"	37.00	36 1/2"	37.50	37"	38.00	37 1/2"	38.50	38"	39.00	38 1/2"	39.50	39"	40.00	39 1/2"	40.50	40"	41.00	40 1/2"	41.50	41"	42.00	41 1/2"	42.50	42"	43.00	42 1/2"	43.50	43"	44.00	43 1/2"	44.50	44"	45.00	44 1/2"	45.50	45"	46.00	45 1/2"	46.50	46"	47.00	46 1/2"	47.50	47"	48.00	47 1/2"	48.50	48"	49.00	48 1/2"	49.50	49"	50.00	49 1/2"	50.50	50"	51.00	50 1/2"	51.50	51"	52.00	51 1/2"	52.50	52"	53.00	52 1/2"	53.50	53"	54.00	53 1/2"	54.50	54"	55.00	54 1/2"	55.50	55"	56.00	55 1/2"	56.50	56"	57.00	56 1/2"	57.50	57"	58.00	57 1/2"	58.50	58"	59.00	58 1/2"	59.50	59"	60.00	59 1/2"	60.50	60"	61.00	60 1/2"	61.50	61"	62.00	61 1/2"	62.50	62"	63.00	62 1/2"	63.50	63"	64.00	63 1/2"	64.50	64"	65.00	64 1/2"	65.50	65"	66.00	65 1/2"	66.50	66"	67.00	66 1/2"	67.50	67"	68.00	67 1/2"	68.50	68"	69.00	68 1/2"	69.50	69"	70.00	69 1/2"	70.50	70"	71.00	70 1/2"	71.50	71"	72.00	71 1/2"	72.50	72"	73.00	72 1/2"	73.50	73"	74.00	73 1/2"	74.50	74"	75.00	74 1/2"	75.50	75"	76.00	75 1/2"	76.50	76"	77.00	76 1/2"	77.50	77"	78.00	77 1/2"	78.50	78"	79.00	78 1/2"	79.50	79"	80.00	79 1/2"	80.50	80"	81.00	80 1/2"	81.50	81"	82.00	81 1/2"	82.50	82"	83.00	82 1/2"	83.50	83"	84.00	83 1/2"	84.50	84"	85.00	84 1/2"	85.50	85"	86.00	85 1/2"	86.50	86"	87.00	86 1/2"	87.50	87"	88.00	87 1/2"	88.50	88"	89.00	88 1/2"	89.50	89"	90.00	89 1/2"	90.50	90"	91.00	90 1/2"	91.50	91"	92.00	91 1/2"	92.50	92"	93.00	92 1/2"	93.50	93"	94.00	93 1/2"	94.50	94"	95.00	94 1/2"	95.50	95"	96.00	95 1/2"	96.50	96"	97.00	96 1/2"	97.50	97"	98.00	97 1/2"	98.50	98"	99.00	98 1/2"	99.50	99"	100.00	99 1/2"	100.50	100"	101.00	100 1/2"	101.50	101"	102.00	101 1/2"	102.50	102"	103.00	102 1/2"	103.50	103"	104.00	103 1/2"	104.50	104"	105.00	104 1/2"	105.50	105"	106.00	105 1/2"	106.50	106"	107.00	106 1/2"	107.50	107"	108.00	107 1/2"	108.50	108"	109.00	108 1/2"	109.50	109"	110.00	109 1/2"	110.50	110"	111.00	110 1/2"	111.50	111"	112.00	111 1/2"	112.50	112"	113.00	112 1/2"	113.50	113"	114.00	113 1/2"	114.50	114"	115.00	114 1/2"	115.50	115"	116.00	115 1/2"	116.50	116"	117.00	116 1/2"	117.50	117"	118.00	117 1/2"	118.50	118"	119.00	118 1/2"	119.50	119"	120.00	119 1/2"	120.50	120"	121.00	120 1/2"	121.50	121"	122.00	121 1/2"	122.50	122"	123.00	122 1/2"	123.50	123"	124.00	123 1/2"	124.50	124"	125.00	124 1/2"	125.50	125"	126.00	125 1/2"	126.50	126"	127.00	126 1/2"	127.50	127"	128.00	127 1/2"	128.50	128"	129.00	128 1/2"	129.50	129"	130.00	129 1/2"	130.50	130"	131.00	130 1/2"	131.50	131"	132.00	131 1/2"	132.50	132"	133.00	132 1/2"	133.50	133"	134.00	133 1/2"	134.50	134"	135.00	134 1/2"	135.50	135"	136.00	135 1/2"	136.50	136"	137.00	136 1/2"	137.50	137"	138.00	137 1/2"	138.50	138"	139.00	138 1/2"	139.50	139"	140.00	139 1/2"	140.50	140"	141.00	140 1/2"	141.50	141"	142.00	141 1/2"	142.50	142"	143.00	142 1/2"	143.50	143"	144.00	143 1/2"	144.50	144"	145.00	144 1/2"	145.50	145"	146.00	145 1/2"	146.50	146"	147.00	146 1/2"	147.50	147"	148.00	147 1/2"	148.50	148"	149.00	148 1/2"	149.50	149"	150.00	149 1/2"	150.50	150"	151.00	150 1/2"	151.50	151"	152.00	151 1/2"	152.50	152"	153.00	152 1/2"	153.50	153"	154.00	153 1/2"	154.50	154"	155.00	154 1/2"	155.50	155"	156.00	155 1/2"	156.50	156"	157.00	156 1/2"	157.50	157"	158.00	157 1/2"	158.50	158"	159.00	158 1/2"	159.50	159"	160.00	159 1/2"	160.50	160"	161.00	160 1/2"	161.50	161"	162.00	161 1/2"	162.50	162"	163.00	162 1/2"	163.50	163"	164.00	163 1/2"	164.50	164"	165.00	164 1/2"	165.50	165"	166.00	165 1/2"	166.50	166"	167.00	166 1/2"	167.50	167"	168.00	167 1/2"	168.50	168"	169.00	168 1/2"	169.50	169"	170.00	169 1/2"	170.50	170"	171.00	170 1/2"	171.50	171"	172.00	171 1/2"	172.50	172"	173.00	172 1/2"	173.50	173"	174.00	173 1/2"	174.50	174"	175.00	174 1/2"	175.50	175"	176.00	175 1/2"	176.50	176"	177.00	176 1/2"	177.50	177"	178.00	177 1/2"	178.50	178"	179.00	178 1/2"	179.50	179"	180.00	179 1/2"	180.50	180"	181.00	180 1/2"	181.50	181"	182.00	181 1/2"	182.50	182"	183.00	182 1/2"	183.50	183"	184.00	183 1/2"	184.50	184"	185.00	184 1/2"	185.50	185"	186.00	185 1/2"	186.50	186"	187.00	186 1/2"	187.50	187"	188.00	187 1/2"	188.50	188"	189.00	188 1/2"	189.50	189"	190.00	189 1/2"	190.50	190"	191.00	190 1/2"	191.50	191"	192.00	191 1/2"	192.50	192"
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## HOW TO CONSTRUCT SKIS

(Continued from page 72)

12 to 15 in. long by the bread-and-butter method and nail the pieces together. The toe should be bent up to a height equal to the width of the ski—in this case  $3\frac{3}{4}$  in.—so lay out the curve on the 4 by 4 in. piece from a point  $8\frac{1}{2}$  in. from the end to a point  $3\frac{3}{4}$  in. from the edge. When the block is trimmed to the line, nail it securely to a single larger board. When placing the block, leave enough space beyond the curved end to put another 4 by 4 by 6 in. block.

The second block is built up in the same way as the first, but instead of a curve there is a shoulder cut into one side of it,  $\frac{1}{2}$  by 4 in. The point of the shoulder is placed against the curved block as shown. Hold it in this position while the toe of the ski is placed against the curved block. Now move the smaller block up against the ski as snugly as possible and nail it securely to the board. Tie the two blocks together on top by nailing on another piece of scrap wood. Be sure it is all very strong.

Wrap rags around the toe of the ski to a point a little beyond the place the bend ends. Hold the wrapped end over a large kettle two thirds full of boiling water, and dip the water onto the rags. Four or five minutes of this should soften the wood sufficiently.

Get the ski into the bending form as quickly as possible, but do the actual bending very slowly. With the toe in place, bend a little and then let up on the pressure, then bend again, this time a little more, and release again. Continue in this manner until the whole curve is bent. Then hold the ski in place with a hand screw or large C-clamp (carriage clamp).

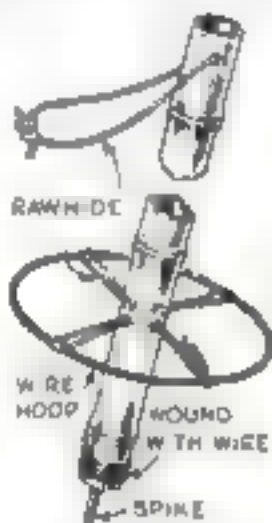
**Ski Poles.** While the bend is setting, you can make two ski poles from a bamboo rug pole. They should be about  $4\frac{1}{2}$  ft. long. Plug one end of each pole with a piece of wood. Lash the end with wire to prevent splitting, and insert a 20-penny spike after it has been cut off and pointed. The snow ring, about 6 in. in diameter, is formed from the iron wire with rawhide webbing. Drill two holes about  $\frac{1}{2}$  in. in diameter through the pole at right angles to each other and about 6 or 8 in. from the spiked end. The webbing is formed as illustrated, that is, the rawhide strips are passed through the holes, and a turn is taken around the ring at four points.

The wire loop is also made of rawhide and should be large enough to allow free movement of the hand and wrist.

**Finishing.** When the skis are completely dry, sandpaper thoroughly. Two or three coats of spar varnish on the top and sides are all that is necessary, but the skis may be stained any color desired and the line design filled with a contrasting color before the varnish is applied. No finish other than wax should be put on the bottom or runner sides.

**Harness.** The harness consists of two straps with buckles for adjustment. One strap passes through the ski and over the toe; the other one is fastened to the toe strap and passes around the heel.

The footplate is a piece of ribbed rubber matting, cemented in place rather than tacked. Place the foot in position on the ski and mark off the spot it covers. The plate should extend an inch or so beyond the actual toe and heel marks.



The upper and lower ends of the ski poles

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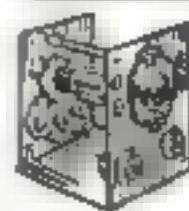
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1940, 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2020, 2030, 2040, 2050, 2060, 2070, 2080, 2090, 2100, 2110, 2120, 2130, 2140, 2150, 2160, 2170, 2180, 2190, 2200, 2210, 2220, 2230, 2240, 2250, 2260, 2270, 2280, 2290, 2300, 2310, 2320, 2330, 2340, 2350, 2360, 2370, 2380, 2390, 2400, 2410, 2420, 2430, 2440, 2450, 2460, 2470, 2480, 2490, 2500, 2510, 2520, 2530, 2540, 2550, 2560, 2570, 2580, 2590, 2600, 2610, 2620, 2630, 2640, 2650, 2660, 2670, 2680, 2690, 2700, 2710, 2720, 2730, 2740, 2750, 2760, 2770, 2780, 2790, 2800, 2810, 2820, 2830, 2840, 2850, 2860, 2870, 2880, 2890, 2900, 2910, 2920, 2930, 2940, 2950, 2960, 2970, 2980, 2990, 3000, 3010, 3020, 3030, 3040, 3050, 3060, 3070, 3080, 3090, 3100, 3110, 3120, 3130, 3140, 3150, 3160, 3170, 3180, 3190, 3200, 3210, 3220, 3230, 3240, 3250, 3260, 3270, 3280, 3290, 3300, 3310, 3320, 3330, 3340, 3350, 3360, 3370, 3380, 3390, 3400, 3410, 3420, 3430, 3440, 3450, 3460, 3470, 3480, 3490, 3500, 3510, 3520, 3530, 3540, 3550, 3560, 3570, 3580, 3590, 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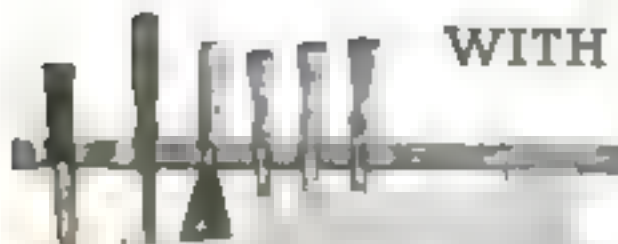
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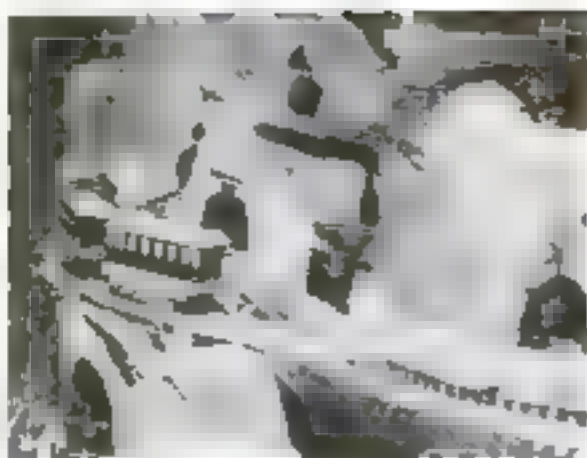
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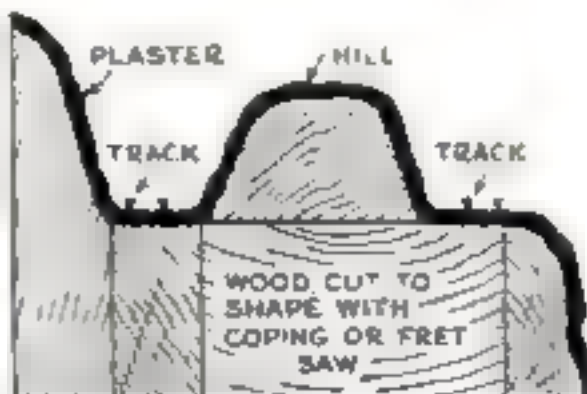
First, make a relief sketch of the scenery that is to be constructed. Then build the required relief out of scrap lumber. Old boxes are the very thing. The general method is as shown in the drawing below. When the underconstruction is complete, small mesh chicken wire is tacked to the woodwork and bent with the hands to form the exact shapes required.

Next take burlap or sackcloth of large mesh and sew it with string to the wire. If a small hillock or knoll is needed, newspaper may be crushed to the hand and shoved under the backing.

The work is now ready for a plaster of Paris mixture. This is applied in small quantities so that as little waste as possible is caused. Mix about three cups at a time, for this substance hardens very quickly. While applying the plaster, form the backing and plaster into the shape desired.

When the plaster is dry, give the whole surface a good coating of size or very thin glue and let it dry for twenty-four hours or more. This leaves a hard nonporous surface that will stand a certain amount of wear. A good thing to do is to scrape off all the small rough edges before applying the size.

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Typical cross section of mountain scenery with two tracks separated by a small hill



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1/2" x 1/2" x 1/2"	1/2" x 1/2" x 1/2"	1/2" x 1/2" x 1/2"	1/2" x 1/2" x 1/2"
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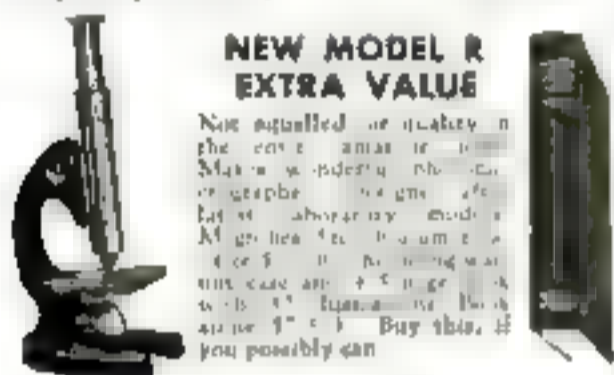
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## ANT'S EQUIPMENT SEEN IN YOUR MICROSCOPE

(Continued from page 13)

responding mostly to odor and touch stimuli. Ants have existed in their present forms for millions of years. One proof that scientists have of this is the specimens embalmed in amber (fossilized resin) millions of years old. Your microscope will reveal, in a few mo-



Illustration showing how the wooden holder for the flask of colored water is assembled. A slit with winged nut makes it possible to adjust the flask at any height or angle required.

ments, just why the ant, and insects in general, have been able to survive where apparently more highly developed animals have perished.

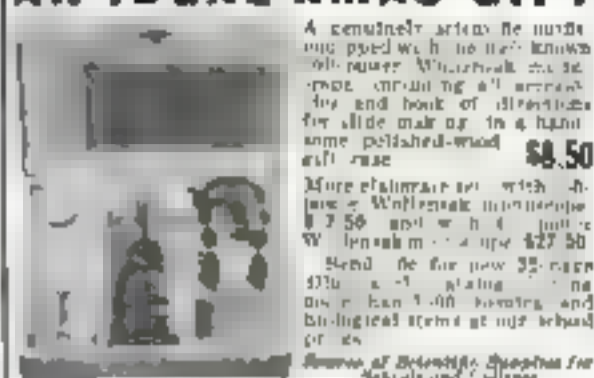
With a sharp scalpel split into two parts the head of an ant. This is easy if you have a dissecting microscope magnifying seven to ten times. Arrange the halves with their flat sides uppermost, on a glass slide, and examine them at moderate magnifications. If the specimen has been prepared properly, you will be able to see how the powerful mandible muscles and other internal organs are attached to the inner surface of the hard shell that forms the ant's head, or "skull." If the specimen had been partly dried in air or by dehydrating in alcohol, slicing the head will not have crushed these delicate structures.

THE ant, therefore, carries its skeleton on the outside, where it will do the most good. In addition to providing the necessary stiffness, the skeleton acts as a suit of armor. No wonder the insects are difficult enemies to subdue when they decide to be unfriendly. Another advantage of the outside-skeleton arrangement is that the attachment of muscles and other organs is simplified. Compared with the ant, you are poorly constructed. The least little bump may damage or destroy one of your delicate organs since it is not protected by armorplate, while a blow of similar magnitude, considering the difference in size, would scarcely be noticed by the ant. Of course, ants in the larval state are not protected by an outer skeleton; but they are guarded by watchful adults who wear natural suits of armor.

From the ant's mouth a gullet leads through the various divisions of the body to the large swollen abdominal section at the rear, where it joins a crop, which is a sac with elastic walls. Next there is a stomach, separated from the crop by a valve, and then the usual intestines and other digestive equipment. Liquids swallowed by the ant enter the crop, and a small portion of the total amount taken in passes through the valve into the stomach. The remainder stays in the crop. The ant is able to force quantities of the crop contents out through its mouth, for the purpose of feeding other ants of the colony.

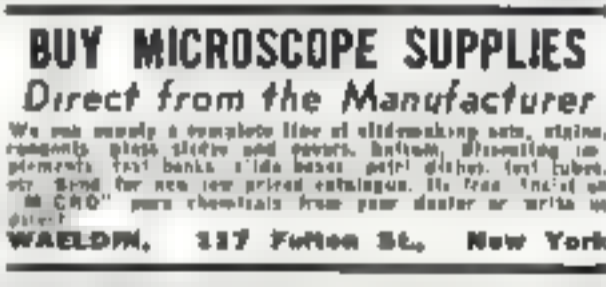
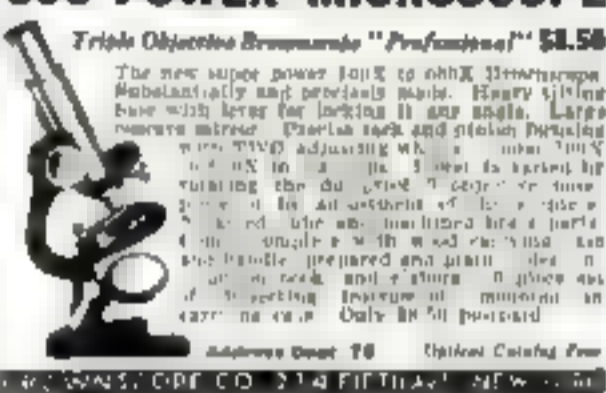
Thus the ant is equipped with a natural storage bin or tank for food. Observers report that certain (Continued on page 95)

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## ANT'S EQUIPMENT SEEN IN YOUR MICROSCOPE

(Continued from page 93)

ants are given the job of obtaining food for the entire colony. These ants sally forth on their errands, fill their crops with liquid food, return to the nest, and distribute it among the other inhabitants by the process of regurgitation. You can watch the crop-filling action by feeding a pale-colored worker some syrup dyed with one of your microscopic stains. When some of the food is given to other workers, their insides become colored too.

**TO EXAMINE** the crop and other organs with your microscope, remove the bulb-like rear portion of the body, place it in water on a hollow-ground slide, and tear it apart with dissecting needles. You may have to dismember several ants before you get suitable specimens. You will note, among other things, the spiral-walled air tubes with which the ant breathes.

A magnification of about 400 diameters, you will find many interesting things to study in and on the ant. You will discover, for one thing, that its shiny armor plate is not as smooth-surfaced as it appeared when viewed with lower powers. The surface of one of the abdominal segments, for instance, is seen to be delicately pitted, like fine leather. Then you will find numerous hairs, or spines, protruding from the surface. Some of these hairs are much larger than the others, and present a peculiarly notched or jointed appearance.

To obtain a specimen of the ant's outside skeleton, suitable for examination at high powers, tear apart an abdominal section as directed, and then separate one of the segments. With dissecting needles, carefully scrape away all unwanted material, press the concave side against a slide, add a drop of water and lay over it a clean cover glass. Tension of the water between the glass surfaces will press the specimen flat.

By all means capture one of the winged ants, for they contain workers not to be found in the common workers. If you cannot find one of them crawling along the ground on a warm day, dig into an underground nest.

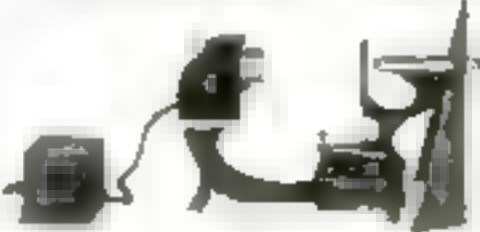
There are, you will find, two pairs of wings, the forward pair being the larger. With sharp-pointed tweezers, remove the wings and mount them in water beneath a cover glass. The wing surfaces, your microscope will reveal, are covered with innumerable tiny spines, or hairs. Examine carefully the front edge of one of the two smaller wings, those that were mounted on the ant's body to the rear of the larger pair. In orderly array along the edge, you will see a series of tiny hooks, curved all in the same direction, like a row of hooks on which the butcher hangs meat in his shop. These hooks look as if they were designed to engage something. Shift the slide until you have the rear edge of the front wing in the microscope field. Carefully move the focusing screw so that you can examine first the upper plane of the specimen and then planes at successively lower levels. You find that the wing edge is curved over to form a groove or channel, into which the hooks on the other wing section fit.

**IF YOU** have studied the honey bee microscopically, you will remember that it was fitted with a similar hooking arrangement. The purpose of this ingenious mechanism is to enable the insect that possesses it to hook its front and rear wings together so that they present a single surface to the air, and thus provide greater efficiency. When the wings are folded, the hooks automatically slip out of the grooves. This mechanism is one of the outstanding wonders of the insect world.

Remove the rear half of a winged female ant's body and (Continued on page 98)

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Illustrating how Microprojector is used in showing a specimen. Image is reflected to drawing paper on table.



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## Secrets of Success

## SILKWORM EXHIBITS PROVE PROFITABLE

lation of an adult silkworm. He kills and mounts the moths with the wings outspread, preparatory to placing them in the school cases. The mulberry leaves he obtains from six trees in his back yard. He planted these especially as a source of feed for his silkworms.

Perhaps a few additional details might be of interest. During the fall and winter he stores the silkworm eggs in a cold storage warehouse, calling for them in May. At that time weather conditions are favorable for the hatching of the eggs. The storage parcel is neither large nor bulky as 33,000 silkworm eggs weigh only one pound.

The silkworm eggs hatch within 10 days and are kept under mosquito netting, the worms being fed mulberry leaves. It requires 30 days for the worms to mature and attain their full size—about 3 inches in length. Then they begin to shrink. They retire to their brush retreat and discharge silken thread from their spinnerets. Each worm shakes its head at the rate of 65 times a minute—each movement being productive of more silk. During the ensuing 3 days, the insect wags its head 300,000 times, finishes spinning its cocoon and produces about 1,000 yards of silken thread.

In addition to supplying the school-exhibit cases to hundreds of teachers, he also sells silkworm eggs and hatched worms to schools, colleges and scientific laboratories. All this material is used for educational and experimental purposes. Research in silkworms has brought this ingenious man a golden harvest. He always has a waiting list for all the exhibits and research material that he can supply.—G. H. D. Washington, D. C.

## THIS PLUMBER CHANGED HIS VOCATION

**IF YOU** should chance upon a certain little plumbing shop in Portland, Oregon, you will get the surprise of your life. For on the walls you will see a most remarkable collection of what I can best describe as "paintings in



wood." Actually, they are pictures executed in wood inlay—all of them the work of F. F. Burditt, the owner. When one looks at these landscapes, portraits and many other subjects, so faithfully and pleasingly executed in wood, it is not difficult to understand why their creator is well on the way to making this work his vocation.

It was not with any idea of selling his panels that this talented plumber became interested in making wood inlays. It was fun—this taking sheets of different kinds

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 2. What country sent the second atomic bomb to the United States?  
 Japan  
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 4. What city was the second atomic bomb dropped on? Nagasaki  
 5. What was the name of the ship that carried the atomic bomb to Japan? The USS Missouri

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### 1.3 A Week in Space Time

**Chey**      **G. Bernard**



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






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FIG. 1

**THERMOSTATS** for controlling house furnaces or boilers occasionally get out of adjustment with unpleasant results. It is really an easy matter, however, to check them and make any necessary corrections.

If it is like Fig. 1, check as follows:

1. Swing the indicator to the left (lower temperature) to stop the burner (Fig. 1)

2. Note the temperature on the thermometer on the thermostat screen.

3. Move the indicator slowly up the scale until a point 1 deg. higher than the temperature shown on the thermometer. At this point the burner should start

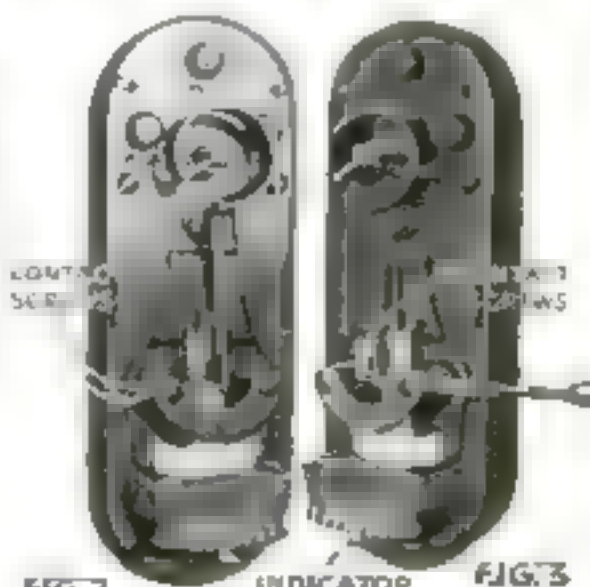
4 Move the indicator to the temperature shown on the thermometer and the burner should stop. The starting and stopping of the burner is indicated by the sound of the motor in the basement or by noting a tiny spark at the contacts.

If the thermostat proves incorrect, adjust it by taking the following six steps:

1. Note the temperature on the thermometer, and remove the screen.

2 Move the indicator to the temperature noted

3. Screw back the contacts (Fig. 1) so that they do not touch the contact blade.



**FIG. 2** **INDICATION**  
*Left:* One screw is turned in, the other out.  
*Right:* The screw is not so much the blade

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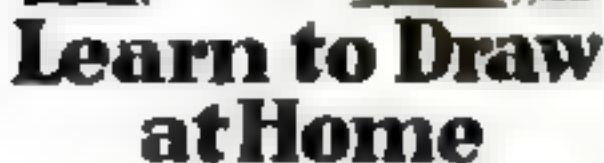
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## THINGS TO MAKE IN THE HOME LABORATORY

(Continued from page 55)

applied with a cloth and rubbed briskly. If the paste is too thick it is made sufficiently fluid by using enough ortho-dichlorotoluene. The home experimenter can store it in convenient collapsible tin tubes in the true commercial manner. Unfilled collapsible tubes can be purchased at almost any drug store. Simply pour in the paste and fold and pinch over the ends.

Any one of a number of simple formulas can be used by the home chemist in manufacturing his own transparent cement. Although a fairly good product can be obtained simply by dissolving scraps of celluloid in acetone or amyl acetate, a far better adhesive can be made by using cellulose acetate in place of the celluloid. The product then will be non-inflammable but because of the solvent used will have a tendency to yellow or whiten as it evaporates. To prevent this, an additional solvent, ethyl lactate, can be added. Being what is known as a "high boiler" it will raise the boiling point of the mixture and retard the evaporation of the solvent.

Taking all of these suggestions into consideration, the home chemist will find that one of the best cements will consist of the following: acetone (ninety cubic centimeters), ethyl lactate (ten cubic centimeters), and cellulose acetate (ten grams). If the result the cement is too thin, it can be thickened by adding more cellulose acetate. Incidentally it will take the cellulose acetate at least two days to dissolve in the solvent so do not be in a hurry to put your finished cement to work.

Another cement employing a plaster to improve its bending and flexing qualities can be made by mixing cellulose acetate with about twenty-five percent of its weight of ethyl phthalate and dissolving it in a liquid made by mixing acetone (fifty parts), ethyl lactate (twenty parts), ethyl acetate (fifteen parts), and toluene (fifteen parts). The resulting cement can be used on any material except rubber and may be packaged in a tin. It takes a little more precaution to keep them a night.

Perhaps you have at some time wondered about the transparent plastic caps often used to cover the vials on medicine bottles and on test tubes and pipettes. These can be made in the home laboratory. In fact, the home chemist can put them to good use in keeping his stored chemicals fresh and free from moisture.

The preservative mixture used in making the plasticine capsules consists of undrained and unsweetened cooking gelatine (eleven grams), water (seven cubic centimeters), and ten drops of glycerin. Heat the mixture slowly over a water bath, stirring it continually. When a liquid results, dip the stoppered ends of several bottles into the solution and allow them to dry. After several hours, their necks and corks will be encased in the same cellulose-like caps that you have always associated with a drug store. If colored caps are desired, the mixture can be colored with any ordinary household dye.

## SALT PROTECTS MINERS FROM HOOKWORM DANGER

Common salt is being used in the deep gold mines of the Rand district of South Africa to protect workers from the parasitic disease of hookworm. By coating corridors, buckets, cages and all exposed earth and waste with a salt solution, the eggs are prevented from hatching and larvae are killed.

## POWERFUL GAS WEAPONS AID WAR ON GANGSTERS

(Continued from page 26)

serve as signals in more extensive operations. Next in size to the field gun is a one-inch riot pistol that looks somewhat like a harmless water pistol, except that it is larger. This pistol is similar to the old Verry signal pistols used in the World War; in fact, converted Verry pistols have been used for gas work. A single shell will make 25,000 cubic feet of space instantly uninhabitable, the effective range being twenty-five feet.

The tear-gas policeman's or watchman's gun is capable of more than denting heads. It is in reality a tear-gas gun, effective anywhere up to twenty or twenty-five feet, depending on size. It is hollow for part of its length, and carries a tear-gas shell which can be fired by releasing a trigger. Normally the trigger cannot operate because of the action of a safety device.

Tear-gas fountain pens, which have been widely distributed to motorists and others desiring protection against holdups, have developed an unfavorable reputation because they look too much like the ordinary type of fountain pen. Accidental discharge by persons not familiar with their true nature is likely to cause discomfort if not more serious injury. So manufacturers are discontinuing the tear-gas pistol that looks like a pen, and which was not considered by gas experts as being big enough to provide really effective protection.

One manufacturer has introduced, as a substitute for the pen gun using a .38 or .410 caliber cartridge, a gas projector using a 20 gauge shotgun shell filled with tear gas. This instrument is almost large enough to serve as a black-jack after it has been fired, but it is a more effective weapon if grasped so that either end can be used like a battering ram. Small enough to be carried in the coat pocket yet using a shell twelve times as effective as the .38 caliber type, this gun has been designed for the use of watchmen, bankers, business men, doctors, gasoline station operators, jewelers, automobile drivers, and even housewives.

Totals with various types of tear-gas dispensers have yielded the following figures, according to A. S. Ailes, of the Lake Erie Chemical Co., Cleveland, Ohio, a pioneer developer of peace-time gas and equipment.

Type	Gas	Weight of Gas	Weight of Shell	Range	Speed
1. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
2. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
3. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
4. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
5. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
6. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
7. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
8. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
9. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.
10. 1/2 in. 12 gauge	100 lb.	100 lb.	100 lb.	100 ft.	100 ft.

Thus the one-inch riot pistol discharges seventy-eight times as much gas as a .38 caliber pen and carries five times as far. Ranges apply to still air only.

A person not expert at throwing grenades can hurl a typical non-explosive tear gas grenade about fifty feet. Such a grenade produces about as much gas as the one-inch riot pistol, but takes a minute to do it. Explosive-type grenades discharge double that quantity and cover a circle thirty feet in diameter. Fast tear-gas candles produce four times as much gas, over an immediate circle of sixteen feet, which rapidly enlarges because of air currents.

TEAR GAS pistols and the like are supposed to be aimed at the chest of the target when the nature of the situation demands this courtesy. However, accidental discharge may cause the gas and wadding to be driven squarely into the face. In such cases, injury may be caused by solid particles of wadding.

The victims of tear gas will find quickest relief by getting. (Continued on page 105)



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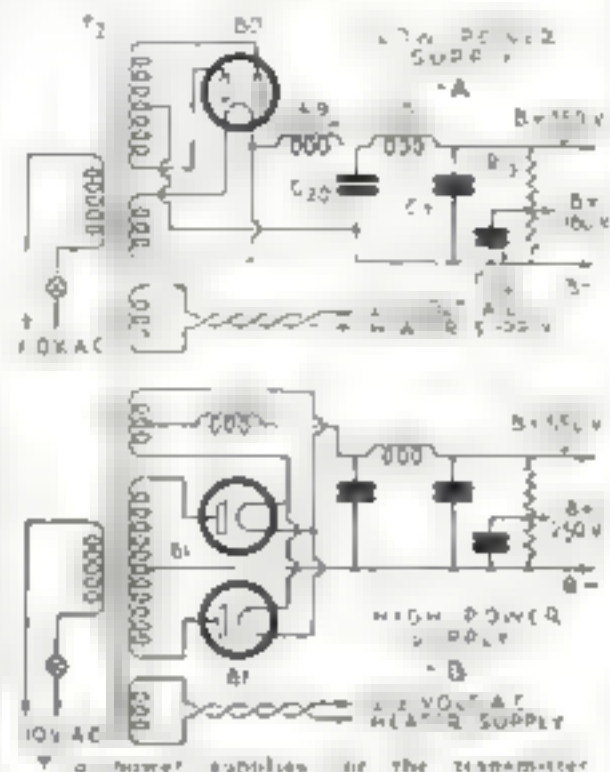
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*Continued from page 57)*

As a final adjustment, the radio-frequency and audio-frequency inputs should be set for proper operation. This can best be done experimentally by listening in on a monitor or an ordinary one- or two-tube short-wave receiver operated without an antenna. The audio-frequency volume control ( $R_1$ ) should be advanced to its maximum value and  $R_2$  de-



The following is a list of the parts needed:  
 X 1/2" x 1/2" x 1/2" and holder 800-XXX-XX  
 1. 1/2" x 1/2" and 1/2" Cuts, see list  
 1. 1/2" and 1/2" 8" chokes, 4 in

(1) Variable condenser, 150 mm.  
 (2) Fixed condenser, 600 mm.

- ( ) Fixed condenser zinc, 004 mfd
- ( ) Adjustable mica capacitor, 1 mfd
- ( ) Fixed condenser paper, 01 mfd
- ( ) Oil paper condenser, variable, 5 mfd
- ( ) Dry electrolytic by pass condenser, 25 mfd, 0 volt

C<sub>1</sub> Variable condenser (5 mmf)  
C<sub>2</sub> and C<sub>3</sub> Variable condensers (0) mmf  
R<sub>1</sub> and R<sub>2</sub> Fixed resistors, 50,000 ohms  
R<sub>3</sub>, R<sub>4</sub>, and R<sub>5</sub> Resistors, 10,000 ohms  
R<sub>6</sub> Fixed resistor, 500 ohms  
R<sub>7</sub> Potentiometer, 50,000 ohms  
R<sub>8</sub> and R<sub>9</sub> Fixed resistors, 50,000 ohms

R<sub>1</sub>—Potentiometer 50,000 ohms  
R<sub>2</sub>—Fixed resistor, wire, 1000 ohms  
R<sub>3</sub>—Fixed resistor 5000 ohms  
T<sub>1</sub>—Microphone transformer


M - Milliammeter 0-50 ma  
Miscellaneous - Two chassis, tubes, shields,  
microphone and battery sockets, etc

**POWER SUPPLY PARTS**  
 L<sub>1</sub> and L<sub>2</sub>—Filter chokes, 5 h 100 mil.  
 C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub>—Dry electrolytic filter  
 condensers 2 x 4 mil. 450 volts 1 C  
 R<sub>1</sub>—V<sub>0</sub> grid divider 10,000 ohm, 50 watt  
 T—Power transformer, 100-volt center  
 tapped at 100 mil. volt at 2 amps., and  
 0.5 x 0.5 at 5 amps.  
 Miscellaneous—Tube socket chassis, etc.

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## HAULING STUNTS BY BIG MOTOR TRUCKS

(Continued from page 15)

Coney Island. In his predicament, the owner appealed to the Gerosa company. Again, its equipment saved the day.

Two trucks and trailers, facing in opposite directions, supported the two ends of the big car. For more than three miles through narrow and often crooked streets, the two machines moved slowly along, one pulling and the other, with dead engine, rolling backward, its driver steering around curves like a fireman at the rear of a hook and ladder outfit.

**T**HE car was loaded on the trailers during the day and the strange journey began at midnight. By dawn, the whale was at Coney Island ready, according to the owner, to "amuse, amuse, and educate" the visitors.

In the early days, the company used to get in touch with the police and go over routes with them before every job of heavy hauling. This is no longer necessary. The big trucks and trailers have traveled so many thousands of miles through the streets without serious accident or damage that the police give them practically free run of the thoroughfares. Whenever possible, heavy traffic is avoided. But sometimes rush jobs send them working their way through congested sections in the middle of the day.

Forty-five-ton electric generators, forty-ton turbine shafts, huge dryers for fireproofing lumber, and a twenty-eight-foot steel torpedo traveled in this way through rush-hour traffic. The torpedo was built by a New York inventor to be controlled in the water by radio waves. Navy officials witnessed trials off Sandy Hook and the Gerosa truck transported the heavy pointed cylinder from the laboratory in the Bronx to the testing place. A special cradle on the truck enabled the men to slide the torpedo into the water at the end of the trip.

Steam shovels and cranes are common loads. The biggest job of the kind was a 110-foot steel boom run by a crawler-type tractor. It was used to lift a war-memorial statue to the top of a fifty-foot marble column. The statue came by truck from Providence, R. I., to New York and the boom, close to half a block long, rode seven miles through city streets to reach the site of the column.

A couple of years ago, when the Bronx County Courthouse was going up, seventy-ton pieces of pink Georgia marble, each eight feet wide, eight feet high and twelve feet long, went to the site by truck. Houses were built over the blocks and sculptors worked inside for months. Another huge block of marble, eleven feet wide and seventeen feet long, traveled on a Gerosa trailer from New York to Washington, D. C., where it was carved into a statue commemorating the Titanic disaster. Frequently, from thirty to forty horses would be required to pull blocks of marble and limestone which now roll along at eighteen miles an hour on the company's trailers.

**S**TEEL jobs run to far greater weights. Forty- and fifty-ton pieces are common and hundred-ton trusses are frequent. From seventy-five to eighty percent can be cut from the costs by fabricating steel at the mills instead of having it riveted together at the place where the building is going up. So larger and larger pieces are shipped from the mills. Only heavy haulage equipment such as the Gerosa company has developed, makes this possible.

When the New York Central Railroad elevated its tracks in one section of New York, not long ago, 100-foot steel sections were brought by truck and lifted into place by cranes as though they were planks. Again, during construction (Continued on page 108)



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## HAULING STUNTS BY BIG MOTOR TRUCKS

Continued from page 12

of the West Side Express Highway along the lower Hudson, sections ninety-seven feet long and all ready even to the railing along the side, were fed by truck to the iron workers at the rate of half a dozen a day.

**T**HE heaviest single pieces of steel ever carried by the trailers weighed 140 tons each. They were sections used on a New Jersey bridge. When carrying unusually heavy loads, the company frequently goes ahead and adds special bracing to the bridges over which the trucks have to pass. Only four times in the history of the company have bridges buckled under heavy loads. In each case, the organization repaired the damage in short order.

It was eighteen years ago that the unique concern was started by Lawrence Gerosa, the head of the company. With a second-hand light truck, he began delivering packages. Later, he bought a heavier machine and hauled bathtubs, radiators, and boilers. While doing this work, he devised new equipment for getting heavy objects into cramped quarters. This rigging enabled him to tackle heavy haulage jobs that stumped other truckers and to get into the field in which his concern has become famous.

At the present time, the Gerosa fleet contains trailers that will hold as much as a freight car and yet will make as sharp a turn as an ordinary truck. Double turntables, tractors with fifth wheels, goose-neck trailers, dollies, and trunnion wheels are responsible for the feats of the machines. On some of the eight-wheeled trailers, the weight is so evenly distributed that a huge load can pass over the cover of a manhole without cracking it. Special equipment is worked out, plans are drawn, and then the factories which produce trucks and trailers turn out the desired apparatus according to specifications.

More than once, Gerosa equipment has rolled along near the head of a famous parade. Three years ago, when Wiley Post and Harold Gatty coasted to a landing at Roosevelt Field after circling the globe in record time, a problem arose. The red and white Lockheed monoplane, the *White Alice*, which had carried them safely on their flight, was too wide-winged to tow across any bridge into Manhattan for the parade of welcome. Finally, it was brought to the East River in a barge, unloaded at Fifty-Seventh Street and towed down Fifth Avenue on one of the goose-neck trailers of the Gerosa company.

Another record breaker that made an overland trip on the same sort of carrier was Gar Wood's speedboat, *Mrs. America X*. At the end of an exhibition at Atlantic City, N. J., it traveled by truck to Boston, Mass., for a motorboat show. As the racing craft held eight tons of engines, there was constant danger that a jar would crack the delicate hull in half. Yet, at the end of the long trip, the trailer delivered the boat in perfect condition.

**T**WO years ago, a ship steamed into New York Harbor with the largest hand-tufted rug in the world. Designed for the main lobby of the new Waldorf Astoria Hotel, it was seventy feet long and almost fifty feet wide. Thirty skilled workers had spent ten months tying the 12,000,000 knots it contained. Together with a smaller rug, it weighed five and a half tons as its box was hoisted from the hold of the ship and placed on a Gerosa trailer.

A power crane was waiting on Park Avenue when the truck drove up to the front of the hotel. It swung the huge box to the sidewalk. The rug was placed on a dozen piano dollies and in a few minutes was safely in the

lobby of the building. Last summer the truck and trailer drove up again to take the giant rug out for a cleaning.

Probably the most curious of all the jobs undertaken by Gerosa men was the rescuing of thirty-six stranded trolley cars. In repaving streets in White Plains, a dozen miles from New York, part of the rails of a street-car line which had just lost its franchise were torn up. The cars were like fish left in a low-water pool. The company that owned them wanted to run them to New York but it couldn't get them past the break in the track. So it sent an SOS to the Gerosa concern.

**I**N A few hours, trucks with special trailers carrying short sections of track appeared in White Plains. The twenty-two-ton street cars were run up on the trailers under their own power, hauled to Harrison, another town six miles away, and run off on tracks that connected with Manhattan. Then motor men ran the cars over these rails to the city where they were put in service. The trucks rode six cars a day and at the end of less than a week had rescued the entire fleet.

Lunch wagons, diners and houses by the score have been carried on the trailers. One winter, a building fifty-one feet long, twenty-seven feet wide and seventeen feet high, was moved three times. It was the headquarters of engineers supervising a subway job. As it contained all the blueprints and other materials needed in the work, it had to be shifted from place to place to keep up with the advancing tunnel. Each time, it was lifted on and off the trailer without even disconnecting the steam heating plant it contained.

Before the completion of the George Washington Bridge, a big load had to cross the Hudson River between Manhattan and New Jersey. As the big boats could not drive under the ferry's low upper deck, the boat had to turn around and back into the slip when it reached the opposite shore. Each trip cost sixty dollars. Three dollars is the present big-load toll on the new bridge.

When engineers were planning this huge span, they consulted the Gerosa company. They discussed developments likely for the future and looked over pictures of the strange, giant loads the trucks are called upon to carry. They wanted to build a bridge to meet the heavy haulage requirements of a decade hence. And they knew that if bigger, heavier, more unwieldy loads are hauled, Gerosa trucks will haul them.

## NEW BOILING POOL IS BORN AT YELLOWSTONE

Tons of rock were dislodged and some hurled thirty feet away, when a new pool of boiling water recently made its appearance in Midway Geyser Basin at Yellowstone Park. At intervals, violent boiling takes place in the muddy water and a slight shock is felt in the ground extending several feet back of the edge. No one witnessed the birth of the new pool which was discovered by one of the rangers while making his rounds.

## BIRDS ARE PASSENGERS ON FAST AIR LINER

When a twin-motored air liner took off from Newark Airport, N. J., recently, twelve of its passengers rode in cages—a dozen prize canaries traveling by air from New York to Atlanta, Ga. It is said to have been the first shipment of canaries by air to the United States. Traveling time was cut to one third



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(Continued from page 23)

The vast preserve was divided by strips of woodland into thirty hunting fields and the edges of each strip sown each year with corn, wheat, barley, rye and millet. This grain provides an unfailing source of provender, not only for the turkeys but for the pheasants, quail, and other game birds bred on the preserve.

The sub-surface fences were, of course, powerless to prevent the entrance of predatory birds and could not entirely bar the destructive rodents. The only sure remedy was traps. So each fall, after the windup of the hunting season, a crew of experienced trappers was outfitted with 40 steel traps and set to work cleaning up the poils.

**B**REEDING naturally consumes most of Bridges' attention, since upon this vital step depends the well-being and growth of the flock. When the first birds were released, Bridges reserved a group selected for their hardihood and quality. The descendants of these breeders, with wings clipped, are kept in a number of fenced and wared ranges, each extending over one and one-half acres and covered with an excellent stand of grass. The fence is wood up to four feet and wire above. The wood is used to keep the birds from injuring themselves by dashing against the wire in an attempt to escape when they are startled. These ranges now hold about thirty gobblers and 200 hens. The best gobblers are valued at \$100 each, the hens at about \$50.

During April, the brood hens are confined to the laying houses. Each hen lays about two dozen brown-speckled eggs about half again as big as a chicken egg. From the total production, about 3000 eggs are selected for incubation. The (Continued on page 110)

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## WILD TURKEY PARADISE SAVES OUR FAMOUS BIRD

(Continued from page 109.)

electric incubator that is used takes the entire job at once and, as a rule, hatches out practically all of them.

For the first six or eight weeks of the young turkey's lives, the period during which they are particularly susceptible to disease caused by dampness, they are kept in heated brooder houses. During this term in the natural state, wild turkey hens have a system of their own to protect their young. John James Audubon, the famous ornithologist, reported that during the wet weather the hens feed the little ones buds of the spicebush, as a human mother might give a child lemonade to counteract the effects of a cold.

WHILE in the brooder house, the young turkeys grow a good coat of feathers and learn to eat mash and grain. They are then removed to the roosting houses next to a carefully tended range. By the time they are three months old they are ready to forage for themselves and leave the roosting houses.

The young birds at this time reveal the wild strain that is in them by scurrying immediately for cover. Were it not for the fine mesh wire enclosing the ranges reserved for them, it is doubtful if the young birds could be kept from going completely native. As the turkeys age, they become nearly as tractable as barn-yard fowl. In the presence of Bridges and of the game-keeper, they exhibit no fear whatever and make no effort to leave the preserve.

The maturing birds destined for distant preserves and breeding farms are shipped by express in special slatted crates, lined with burlap to protect the birds from injury. Since even grown turkeys are likely to contract disease from too prolonged contact with water, moisture is supplied them by means of apples which are halved and placed in the crate. For food en route, the bird is given unshelled corn. Thus provisioned, it can make a four- or five-day trip.

Usually about 2,000 to 2,500 turkeys are thus distributed each year. Extra birds are liberated to join the other domestically raised but now wild turkeys on the preserve. It is these birds that each fall furnish such ideal sport for the millionaire members and guests of the Woodmont Club.

IT IS not necessary for these privileged hunters to confine their attention to wild turkeys, however, for the preserve abounds in deer, quail, pheasant, and mallard ducks. Every year a 10,000-egg incubator hatches out 4,000 ducklings, 4,000 young pheasants, and 2,000 quail. A careful check is kept of the kill and, as a check on this, an annual game census is taken. In this way, the club learns just what replacements are necessary to keep the flocks at the maximum set by the food supply.

Pheasants and quail, after hatching, are kept in range houses and, during the hunting season, are driven over blinds by beaters. About forty percent of the birds are killed in this way, the others escaping to the preserve where they are later hunted over dogs.

The 400 Virginia and white-tailed Michigan deer on the preserve are bred not only to provide sport for club members but to distribute to other hunting preserves. Hunters kill from fifty to seventy-five animals yearly making it necessary to dispose of a dozen or so more to keep the herd within limits.

Within the enclosure, however, the most popular sport has always been, and probably always will be, that of shooting wild turkeys. This is game that by its quick wit, its courage, and wariness gives the hunter the greatest sense of triumph when he is fortunate enough to bag one.

## DON'T LOOK DOWN ON YOUR FEET

(Continued from page 39.)

Toes were narrowed and lengthened. Civilized man had started on the painful job of making his feet fit his shoes.

That job is still being carried on, but not to the extent that it was a quarter of a century or so ago. More and more people are demanding, and getting, comfortable and well-fitted shoes. For that improvement we should thank an army surgeon. Remember General Edward L. Manson. The famous "Manson last" shoe that he designed for our army gave regulars and National Guardsmen a taste for real foot comfort which they carried back into civilian life. The civilian shoes of today are more graceful than the army shoes, but there is scarcely a man's street shoe made in America that does not show the influence of General Manson's ideas.

EVEN women's shoes have been influenced by the trend toward more comfortable footwear, although most women still disregard the advice and warnings of physicians and foot specialists and continue to wear high heels. And many of the ladies, regarding their feet as desirable, insist on disregarding plain facts and wearing shoes that aren't large enough for their feet. In that respect they are less sensible than the Chinese women who, after centuries of binding the feet of baby girls to keep them small, took advantage of the Chinese revolution to demand and achieve foot freedom.

How can foot troubles be averted and how can they be cured?

For information on those questions I called on Dr. Louis Schwartz, a surgeon of the United States Public Health Service, who has made a study of vocational foot troubles, and who is an authority on the hygiene of the feet.

Our feet, Dr. Schwartz told me, "often are ruined, because of our occupation or of our mode of dress, to do their work under unfavorable conditions. This results in the weakening and impairment of them, and unless we take special care of these often overworked parts, they will break down."

"The best preventive for corns and calluses, bunions and increasing tendons, overlapping toes, and other foot deformities that are painful and that lessen our efficiency, is a simple one: Just wear shoes and stockings that are long enough and broad enough not to cramp your feet."

"Shoes should be broad and roomy at the toes. The inner borders of the sole and heel should be in a straight line. The sole should be moderately thick, thick enough for adequate protection, but not so thick and rigid that it will hamper the normal motion of the foot in walking. It should follow the natural shape of your foot, and should project a little beyond the outline of the toes. It should be perfectly flat from end to end, and from side to side."

HEELS should be broad and low, and the shank should be narrow and flexible. Care should be taken to see that the shoes fit well around the instep. The tops should be made of soft leather.

Both the length and breadth of the foot increase about half an inch when the weight of the body is thrown on it. For that reason always be sure, when buying shoes, that they are large enough to be comfortable when you are standing with all your weight on one foot. Take plenty of time when you buy a new pair of shoes, and insist that the salesman fit you proper.

"Be sure that your stockings are longer than your feet. Stockings that are too short are the cause of bunions and many other foot troubles."

"Many women (Continued on page 111)

This One



E2CQ-AWJ-TTE4



## DON'T LOOK DOWN ON YOUR FEET

(Continued from page 110)

who have become accustomed to wearing high-heeled shoes say that they find low heels painful. Of course, they do. Constant wearing of high heels shortens the muscles on the back of the calf of the leg. To go from high heels to low heels demands the stretching of these muscles, a process that is naturally painful. The best way is to decrease the height of the heel by degrees. Occasional wearing of high-heeled shoes on dress occasions isn't especially harmful, but they should never be worn when there is much walking, or prolonged standing, to be done. Nature intended us to stand and walk in such a position that the heels are on the same level as the toes. High heels tend to make us fall forward, to disturb the relation of our internal organs, and to deform the arches.

**"TO PRESERVE** our arches, it is very necessary that we walk naturally. The natural, and therefore the correct, way is to walk with the feet pointing straight forward, and parallel with each other. Young children should be taught to walk in this manner.

"The outer part of the longitudinal arch is the outer border of the foot. It is more solidly braced, and therefore better suited for weight carrying, than is the higher and more elastic inner side of the arch. If the feet are pointed straight ahead in walking, the weight comes on the outer edge of the longitudinal arch, where it belongs. If the toes are turned out, the weight is thrown on the inner side of the arch, and tends to break it down.

"Sometimes weak feet can be made strong by exercises. Here are a couple that are good: "Rise as high as possible on the toes. Turn the heels outward and the inner sides of the foot inward. Come down slowly. Repeat twenty or thirty times.

**"STAND** on the outer borders of your feet, with your toes turned in. Rise as high as possible on the toes, and slowly sink down, turning the feet so that the weight rests on their outer borders.

"Riding a bicycle is a good method of strengthening weak feet. When sitting down, it is a good habit to cross the feet, not the legs. This brings the feet to rest on their outer borders, and puts the entire body in a relaxed, restful position.

"During the past few years we all have heard a good deal about the ailment commonly called 'athletes' foot.' We have heard so much about it that some people have come to regard it as something of a joke. But it isn't any joke. It is painful, bothersome, and occasionally really dangerous.

"Athletes' foot is caused by the ringworm organism which thrives in dampness. Its most common symptom is cracking and scaling of the skin between the toes, but sometimes it shows up in a skin eruption on some other part of the body, caused by the system absorbing pus generated by ringworm fungus growing between the toes.

"To guard against athletes' foot, care should be taken always to wear slippers or sandals while using public or semi-public shower baths, swimming pools, or locker rooms. Household pets often carry the infection, so it is unwise ever to go barefoot where they are present. After a bath, the skin between the toes should be dried gently but so thoroughly that no moisture remains. Stockings should be changed frequently.

"The person who has contracted this ailment should, in common fairness to others, refrain from using public bathing facilities, and from going barefoot in locker rooms. Care, and the use of a good antiseptic foot powder, sometimes will work a cure, but it is better to consult a physician."

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SOME of the world's best inventions came from men who didn't consider themselves inventors at all. The typewriter was invented by a painter, the typewriter by a lawyer, a book clerk figured out the hand camera, a dentist the stock ticker. Or look at small inventions: A housewife noticed her wife bending a hair pin to make it stay put. That gave him the idea of the crinkly hair pin. One day a golfer got the idea to make a wooden tee. Now wooden tees are sold by the millions every year. There are many similar examples in invention history. That is why we say that the book shown here is for INVENTORS and Other Men with IDEAS. Whether you consider yourself an inventor or not—if you have an invention that will make money, save time, save labor, or give pleasure—you should find out how you can protect your rights to it. And this interesting, FREE book, PATENT PROTECTION, will tell you.

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# Collecting Butterflies Thrilling Home Hobby

(Continued from page 12)

young collector who has captured tens of thousands of butterflies and moths around Los Angeles has developed a simply made trap requiring no special care. Cut the bottom from a large funnel, leaving a two-inch projection. Cut a one and one half inch hole through the top of a one-quart mason jar, insert the funnel stub, and solder tight. Fasten the funnel to a metal roof by wires or strong cord, attach an electric light bulb underneath the roof, and place cyanide in the jar.

**SET** the trap out at night and take out your catch the next morning. Set it on high ground, so the light can be seen from a distance at the edge of an open spot in the woods, a meadow, creek, or river bottom. Try it in different locations and you will be surprised how easy it is to catch moths.

Here is another trap easy to construct. Make a box ten inches wide, fifteen inches high and twenty inches long, leaving one side of the box hinged at the top and one end of the box open. Inside the box near the closed end place a small coal-oil lamp or an acetylene lamp. A round hole is cut in the top of the box to allow the heat of the lamp to escape and over this hole is a cover made from a tin can. Place a piece of bright tin back of the lamp for a reflector. In front of the lamp install a glass partition and immediately in front of this partition cut a hole in the bottom of the box in which is fitted the open mouth of a killing jar. The top of the killing jar should be level with the floor. In front of this an opening is made by two panes of glass. The opening between these two pieces of glass should be about three fourths of an inch wide. The moth enters through this opening and in trying to get to the light falls into the cyanide jar which should contain sufficient cyanide and moisture to act quickly. On dark nights a great many moths can be caught this way.

**BUTTERFLIES** and moths destined for the owner's own collection may be expanded for mounting as soon as they have been killed, and doing this properly spells the difference between a slovenly collection and a handsome, well-kept one. To expand a specimen, place it back down on a soft board and pin it through the body, from the underside, onto the board. Place a pin on each side of the body far enough back to keep the body straight. Draw the forewings forward until the rear edges are at right angles to the body, forming a straight line across the body; then pin strips of paper over them to hold them in that position. Next bring each lower wing up to the edge of the forewing and pin strips of paper over it to hold it in that position. Transparent paper is best and some collectors use architects' tracing cloth. These strips of paper may be cut in convenient size and used many times. Sometimes strips of glass are laid on to hold the wings in position, but one usually has better success with the paper strips. A pin is generally used to move the wing into position, catching it back of the upper rib of the wing, being careful not to make a hole through the wing. Do not

pin through the wing but pin the strips of paper just outside the edge of the wing. The antennae should be held in position by placing pins on each side. The most important point in spreading butterflies is to bring the forewings forward until their lower margin forms a straight line across the body. After the specimen is properly expanded and pinned onto the board, hold the body down and remove the pin that fastened it to the board while it was being spread. Leave specimens pinned to the board until they are thoroughly dry, a week, if spread when first killed.

Both butterflies and moths properly displayed on cotton under glass are very attractive and retain their beauty for a lifetime. You can make your own mounts at very little expense. Get empty cardboard boxes approximately an inch deep, such as handkerchief or glove boxes. Fill with sheets of cotton batting cut to shape. On top of this cotton place a thin layer of pure white hospital absorbent cotton.

Now take the top of the box, and with an even strip of wood for a ruler, cut out the center with a sharp knife or safety razor, leaving a margin one half inch wide of the top remaining. Next take a piece of window glass so cut that it will fit snugly inside the box against the top and glue it in place. The material generally used to cover these mounts is black pebbled paper that looks like leather and is inexpensive. When the mount is completed place your butterflies on the cotton and put on the cover of the box, which is now a glass top through which you can see the specimens. Sprinkle some powdered moth balls or naphthalene flakes in the bottom of the box or between the sheets of cotton. This will save them from the pests.

**YOU** can get several different sizes of boxes from the usual drygoods store or you can use sheets of cardboard and make up any sized mount that you want. You can use pressed flowers, grasses, etc., in connection with the butterflies and many of you who live in the country can obtain the silklime from the pods of the milkweed in late summer or fall that will come in nicely in mounting your specimens.

When you cannot mount a freshly-killed specimen immediately, or if it is intended for exchange or sale, it should be placed un-

mounted with wings folded back to back in a triangular paper envelope. These envelopes are easily made.

Cut your paper to the following sizes: three and one half inches by five and three fourths inches for small butterflies, four and one fourth inches by seven inches for medium sized butterflies, and five inches by eight and one-fourth inches for large butterflies.

Referring to the diagram accompanying this article, first fold number 1, next number 2-3. Use any medium soft paper like newspapers but do not use heavy glazed paper. If you select plain paper, however, it is easier to write any memoranda on it. This is the way that your envelopes must be made if you expect to take proper care of your specimens. Do not use thin tissue paper.

**THOUSANDS** of specimens are made unexchangeable each year by the failure of collectors to take proper care in putting them into the triangular envelopes. It is not enough simply to put their wings in resting position and put them in the envelopes any old way. Put them in as instructed, with the antennae facing along the fold. Specimens thus stored may be kept safely for many years, or can be sent by mail anywhere. At any time desired, they may be softened and expanded for mounting in the following manner:

Place some blotting paper, moistened with water in which you have put a few drops of carbolic acid, in the bottom of a tin box or any vessel with a tight-fitting cover. Put the butterflies in this box, and cover and leave them until they become as soft and pliable as when first killed.

Butterflies may be removed from the triangular envelopes before placing them in the softening box or they may be left in the envelope, which usually takes longer to soften them properly but involves less danger of breaking them or making them wet or soggy. If taken out of the envelopes first, paper should be placed over them in the softening box to prevent drops of water condensing and falling on the specimens. With a little practice you will have no trouble in softening them.

When sufficiently softened, remove the butterfly from the box and mount it as previously described, except that only two or three days will be needed for drying.

Throughout the world collectors are eager to exchange rare and beautiful butterflies for others not found in their particular country. Some of my most prized specimens have come to me from amateur collectors in far-distant places. For that reason, it is important to pack your specimens properly for shipment. Small lots may be sent by mail to almost any part of the world in cigar boxes or other light but strong wooden boxes. If cigar boxes are used they should be enclosed in corrugated cardboard and then securely wrapped in strong paper and they should be tied securely with strong twine.

By such exchanges you can round out what may easily become a fine, representative collection of butterflies, not only of your own locality but also specimens from all parts of the whole world.

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Listen to the five continents with your Midwest. Have received Madagascari, London, Paris, Vienna, Moscow, Madrid, New York, Shanghai, Tokyo and also South American transmitters. Marquis II, Buchanan, Apartado 94, Pinar San Martin, 171.



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4. Station Group Locator;
5. Simplified Tuning Guide Lights;
6. Automatic Select-O-Band Indicator;
7. Illuminated Pointer Indicator;
8. Silent Shadow Tuning—Improvement on Meter Tuning;
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